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Planet Play: Designing an educational game for children to promote environmental awareness.

by

Maria Goncharova

A thesis submitted to the Faculty of Graduate Studies and Research
in partial fulfillment of the requirements for the degree of

Master of Design

in

Visual Communication Design

Department of Art & Design

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PLANET PLAY


DESIGNING AN EDUCATIONAL GAME FOR CHILDREN
TO PROMOTE ENVIRONMENTAL AWARENESS.

MARIA GONCHAROVA

*Master of Design Thesis Report
Visual Communication Design*

*Department of Art and Design
University of Alberta
Winter, 2013*

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For Lyudmila and Alexander.

ABSTRACT

This document presents the process and outcomes of an exploratory design research project, conducted as a graduate degree study by a visual communication designer. The process consisted of combining the subject areas of game development, user-centered design, child psychology, and environmental preservation, with a visual analysis of 30 existing educational environmental games. Two participatory workshops with children attending the fourth grade of elementary school were conducted. The first workshop examined the environmental awareness of child participants and their preferences regarding existing environmental board games. A prototype of a board game – *Planet Play* – was created in response to the first workshop. A second workshop followed, where the *Planet Play* prototype was tested with the same child participants. The observations of participants and their feedback regarding the prototype were evaluated and applied towards refining the prototype of *Planet Play*, which was then displayed as the supporting visual component to the design research. This project also led to the creation of a framework, which potentially could be useful for designing similar educational board games.

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PERSONAL STATEMENT

Games, Design, and Environmental Education

Games have been important to me since my childhood, when I regularly played various board and card games with my parents; my father even invented some game hybrids for me to enjoy with my friends during play dates. Based on my own beliefs and supported by research I came across while working on this thesis, play and learning seem to be inseparable. It was playing games during the developmental stages of cognition and character formation, from early childhood to early teens, that has been significant for my own development of logic, concentration, deduction and visual skills, and most of all, something that will now bring me fond memories of the past. Furthermore, the possibility of a game being passed down from generation to generation as a sentimental relic is a romantic notion which I embrace and perceive as something to be held on to and preserved, especially today, in the age of ever-changing information technology. I have experienced the educational power of play, and therefore believe that games have the potential to educate and present information in a way that would be otherwise impossible to present in reality; for instance by creating scenarios and worlds for players to exist in, experiencing hypothetical situations and finding ways to overcome difficulties that can range from zombies to bankruptcy and natural disasters. Furthermore, the potential of games to speed up or slow down the pace of time, situate players in abstract or realistic scenarios, and offer them the greatest tool of all – the chance to overcome the obstacles and reach their goal, emerging in a winning capacity – all of these are acts that can be accomplished by players in the process of playing a game and within the time frame of under an hour*. It is therefore the infinite potential of games as representational and educational tools that attracted me as a designer interested in social design and design interventions.

Initially entering the field of social design through the fascinating world of guerrilla advertising, I gravitated towards the notion that the universal language of design – which is used to inform, clarify, and instruct – is a powerful tool that must be made use of for positive social causes and not simply mercantile ones. Campaigns, products, and signage created for globally relevant causes [such as *Amnesty International*, AIDS research, *WWF*, climate change, cancer awareness, etc.] were exactly the type of social design that interested me, as they combined the power of design with socially acute causes. Today, the subjects of climate change and environmental deterioration are both personal and global concerns, which I was interested to address with design in a manner that would bring about awareness regarding these issues. Combining my love for games with the subject matter of environmental preservation, I arrived at the desire to create a prototype of an educational game for children to promote environmental awareness. Children were chosen as the target audience for this project because of their young age, still in early cognitive development, their ability to process and retain information is different from that of adults. Furthermore, the role and power of children as future decision makers and inhabitants of our planet made the connection between them and environmental preservation an obvious one for me. Consequently, working together with children on creating a game concerning the subject of environmental preservation seemed like a refreshing deviation from the often heavy and frightening tactics used today in social design interventions.

*NOTE *All games are different – the goals, the setting, the amount of time necessary to complete them – I am generalizing in order to point out the stark contrast between real time and game time.*

INTRODUCTION

The aim of this design research project was to focus on a globally relevant social issue and to explore it in a playful and non-conventional way, communicating its significance to the public with and through design. The universal language of design – and thus design’s ability and power to communicate – could be used for interpreting and illuminating socially vital issues, thus bringing about awareness regarding socially pressing subject matter, both within and outside of the discipline of design. Disciplines outside of design can potentially be introduced and merged with the field of design in the process. By doing so, design becomes a translation tool, aiding in the deciphering of the specific codes carried by various disciplines, making their content and messages comprehensive and accessible to the general public.

Research Question

The mediums of games and play were chosen for the purpose of exploring a serious subject [environmental deterioration and preservation] in a playful way, allowing for the opportunity to initially distract players with the excitement and carefree nature of engaging in a game, while simultaneously integrating key concepts, techniques, and environmental messages into the core of the game. Children – ages nine to eleven – were selected as the target audience for this design research project, focusing the medium of games and play towards people in the earlier stages of their development. Therefore, designing a game that would explore notions of environmental preservation and communicate these notions to children, eventually led to the research question of ‘how to design an educational game for children to promote environmental awareness?’

Various subject areas were explored, as design theories and practices alone could not support the creation of such a game. The basics of child psychology and cognitive development, notions of environmental deterioration and preservation, game anatomy, theory and practice of game development, as well as user-centered design and participatory collaboration were all subjects to be considered. A prototype for the educational environmental game *Planet Play* was developed based on the analysis of existing environmental games and the feedback on these games, which was provided by the children participating in the research process. The prototype was tested with the same child participants; their suggestions and experiences were recorded and analyzed in order to apply them to refining the prototype. Socially relevant issues of environmental deterioration and preservation guided the content of the game prototype to be derived in part from the science curriculum of the school where the game was tested, and in part from the experiences and preferences of the student participants who tested existing environmental educational games. Thus, an active involvement of the students in the design process was combined with information from the science curriculum of their school.

The name of the game – *Planet Play* – originated long before the development of the framework or the inception of the game prototype. *Planet Play* came to be in part as an aesthetic design decision – paying tribute to typography, and the visual repetition of letters and sounds the juxtaposition of the letters created – and in part as a subconscious response to the explorations of existing environmental games. The roundness of the sounds referenced the roundness of the planet Earth; the word play was integrated into the title indicating a connection to games and entertainment. By designing an educational game with the help of children, the design process became richer and more intuitive, as all the insights and suggestions offered by the participants increase the usability and content of the game.

The process of designing an educational game also led to the development of a possible framework, which could be applied towards designing and testing similar educational games in the future. The framework could be understood as a series of steps or procedures, that are carried out in order to arrive at the design of an educational board game. The steps include collecting and evaluating existing games by visually analyzing and categorizing them, filtering them to decrease their number for the testing process. User-centered participatory workshops with the target audience of the games are carried out, where the games are tested and reflected upon; the workshops are observed, guiding the game developer towards the creation of the game.

This document presents the process and outcomes of an exploratory design research project. Beginning with a review of the literature on play and the role of ludic activity in child psychology and cognitive development, notions of environmental deterioration and necessity for environmental preservation, game anatomy, theory and practice of game development, as well as user-centered design and participatory collaboration with children. The process of a visual analysis of existing games, followed by two participatory workshops with children, and the development of the *Planet Play* prototype are discussed. Limitations and suggestions for future development are identified.

Definitions used in document

active learning

non-conventional and non traditional forms of learning, such as learning via ludic activity;

cognitive development

the development of mental processes related to reasoning, thinking, comparing, judging;

graphic elements

elements pertaining to art and design, such as line, color, shape, texture;

information design

the arrangement and representation of data by the use of principles and elements of design;

inquiry-based learning

learning through exploration and active engagement with information;

ludic activity

playful and any play-related actions, such as engaging in games, sports, performing, etc.;

playtesting

the process of testing a game in various stages of its development;

scaffolding

temporary assistance, particularly related to situations where new knowledge is acquired;

typeface

a family or set of characters that share design similarities, such as the anatomy of the characters;

user-centered design

the design of a product or service with / by the involvement of the intended user in the process.

LITERATURE REVIEW

Play has been an essential aspect of life from the earliest stages of life's occurrence – both for animals and for homo sapiens. Visual artifacts indicating playful [or *ludic*] activity and tools for playing have been discovered from different eras as well as in separate geographical locations, and “anthropologists have often enough described games, sports, esthetics, and other forms of play” to be “so deeply rooted as mammalian behavior that they cross species, genera, families, and orders” (Norbeck, 1974, p. 2). Play was a fundamental expression for early humans and has since been claimed by sociologists, anthropologists and psychologists to be indispensable for the development of societies and social order.

In *Homo Ludens*, Huizinga discusses the position of play in cultural traditions and creative practices, declaring that play did not originate from culture and various social rituals, yet culture and rituals were formed through play and the emotional fulfillment play brought to those engaging in it. Play creates a positive release of energy and emotional pleasure; it can be interpreted as “a discharge of superabundant vital energy,” a “satisfaction of some ‘imitative instinct’, or again as simply a ‘need’ for relaxation” (Huizinga, 1970, p. 20). Humans play for hundreds of reasons and without reason; they play to pass the time, to enjoy connecting with others, to utilize a vast range of expression, from exploring emotions or creativity to showing off a particular skill set. Playing is a form of communication and essentially has no language limitations, making it a universal bonding experience. Huizinga mentions the simplicity and universality of play, and its purely recreational side, yet ludic activity could become functional just as easily. A strong connection between play and the progress of society is observed by Huizinga, who classifies and defines different forms of play, exploring how ludic activity relates to language, law, war, development of knowledge, poetry, mythology, philosophy, and artistic expression. Huizinga attributes the connection of progress and play to be rooted in the balance between entertainment and rules; the “fun-element that characterizes the essence of play” (p. 21) and the premise that play “creates order, is order. Into an imperfect world and into the confusion of life it brings a temporary, a limited perfection. Play demands order absolute and supreme” (p. 29). Play and its impact on the development of knowledge has been explored by cognitive developmental psychologists like Piaget, Vygotsky, and Bruner, who all in their own way attributed the development of children's thought and skills to play.

Piaget's theory of cognitive development [based on his observations of his own children playing], describes four stages of progress, where children change and evolve with each of the stages as they mature. *The Essential Piaget* (Gruber & Vonèche, 1977) discusses cognitive development taking place through physical actions, which later lead to the advancement of mental operations. Developmental processes involving tactile experiences allow children to change and build upon previously formed schemas of behavior [which consist of knowledge that is newly being acquired based on knowledge that has already been acquired]; children go through ‘adaptation’, which occurs when they apply previously learned knowledge to new and unfamiliar situations [assimilation], while simultaneously altering their behavior as a response to the new knowledge formulated in the process of mastering said unfamiliar situations [accommodation]. If ludic activity is factored into the process of cognitive development, mastering tasks and unfamiliar situations could become more pleasurable and engaging for children. In fact “imaginative play, in Piaget's theory, is a basic component of the second stage of cognitive development”, it is a state “between the purely situational constraints of early childhood and adult thought, which can be totally free of real situation. Thus further cognitive development could

not occur without the liberating effects of imaginative play” (Hardeman & Peisach, 1985, p. 233).

Not all play theorists however, associate the idea of ludic activity with order, precision, or progress. In his book *The ambiguity of play* (1997), Sutton-Smith collects and examines various approaches to play and its functions, however disagrees with Huizinga’s view of play as progress, stating that play cannot be understood and defined as ordered or precise, but is a flexible and flowing state. He entertains the connection of play to evolutionary processes, describing ludic activity to be mimicry of Darwin’s “struggle for survival” (Sutton-Smith, p. 225), however questions the extent to which play contributes to the development of children. Sutton-Smith argues that play by itself does not necessarily lead to development, yet it is the interaction between children and their peers or adults, which causes learning and development, “pretending, enacting, choosing freely [...] with little or no emphasis on the kind of growth that adults have in mind with their progress rhetoric” (p. 49). Therefore, the presence of assistance and guidance is a required ingredient for learning to occur, a concept originally described by Vygotsky in his many works and later coined by Bruner, who developed the notion of *scaffolding*. By incorporating scaffolding into educational materials and teaching techniques, a significant improvement of information acquisition and retention has been observed in children, as “scaffolding incorporated in formalized activities within systems of designed books, software, materials for learning and other artifacts crafted specifically to promote learning activities... enable the learner to do more than he or she would alone” (Pea, 2004, p. 429).

Numerous studies have been performed in the area of education, play, and cognitive development. Christie and Johnsen in *The role of play in social-intellectual development* (1983) review some of these studies “in an attempt to assess the current status of this important area of inquiry” and their findings indicate the following:

Because play appears to affect other desirable patterns of intellectual functioning like divergent thinking and problem solving, we argue that play may have a more basic function in education than many educators believe. The concept of basic education perhaps should include aesthetic experiences that encourage play. Furthermore, play can be integrated into other traditional curriculum areas with similar benefits. Encouraging a playful approach to the academic environment [...] may result in a more creative understanding of the content or solution to a problem. (Christie & Johnsen, p. 112)

Moreover, the promoting of creativity and encouraging of development can be observed within the Montessori method of education. With her ideation of the *prepared environment*, Montessori revolutionized the educational approach, claiming that everything in a classroom should be designed to assist the learning process, so as to enhance and increase individual exploration – “the Montessori method is attuned to the education of the individual child, who, while in a group setting, independently pursues his or her own work” (Montessori & Gutek, 2004 p. 56). Her method is defined by the following general principles – availability of assistance, necessity of physical movement, interaction with the prepared surroundings, freedom of choice within the prepared surroundings, challenging educational material, and a system for evaluating of achievements. Applying these principles to a classroom or a curriculum, would maximize a child’s learning experience, because “young children are natural inquirers and problem solvers. They have a keen interest in the materials around them and move naturally into activities that involve manipulation of materials, exploration and discovery” (Science, 1996, p. A.1).

In *Designing brain compatible learning* (1998) Gregory and Parry discuss the difference between ‘eustress’ and ‘distress’ – concepts similar to Sutton-Smith’s exploration of play as an imitation of the struggle for survival. Whether remembering previously acquired information or being in the process of learning new information, the “survival-oriented parts of the brain” (Gregory & Parry, p. 9) become active and the body experiences stress – the stress can be positive, euphoric [*eustress*] or negative and paralyzing [*distress*].

Eustress [...] puts us in a state of heightened awareness in which our ability to learn is at its optimal level. Distress has the opposite effect and triggers the release of neurotransmitters, such as cortisol, that may cause the thinking parts of the brain to function below peak efficiency. [...] If students are to learn efficiently, stress needs to be kept within tolerable levels so that their self-esteem and personal efficacy remain intact. Strategies such as cooperative group learning and metacognitive reflection, which promote social interaction and allow students to discuss their emotions, are effective tools for creating tolerable level of stress and, hence, a climate conducive to learning. (Gregory & Parry, p. 10)

Inquiry-based, active methods of learning – such as any non-traditional purely theoretical instruction in classrooms – could therefore help students avoid distress and encourage eustress, enhancing their learning experience.

The Elementary School Science Curriculum of the province of Alberta employs inquiry-based methods of education, ensuring a strong focus on the principle of active learning and exploratory education. Students “enter school having learned a great deal about their world through play and exploration” (Science, 1996, p. A.1), therefore their science experiences in the elementary years “...are designed to build on the knowledge that students already have and to extend and sharpen their investigative skills” (p. A.1). Students can apply the skill set they have polished over the years – playing and associating play with entertainment – to a more serious setting, where information retention is required; therefore, effective information retention is best achieved in a manner that is both familiar and non-taxing for the student. Given that “students learn best when they become personally involved in their learning – not just when they mechanically follow a set of steps or read and hear about things learned and done by others” (p. A.1), numerous research studies on the value of educational games have been conducted, examining the field of active learning and its integration into traditional school curricula.

Research performed with classrooms of children has produced varying results regarding the measurement of efficacy generated by ludic activity in relation to the understanding and retention of academic material. According to Mainemelis, Ronson, (2006) and Stott (1978), ambiguity in results arises from the fact that the performance of a single child cannot be isolated from group results and measured in a purely scientific manner; factoring in the intangibility of play as an act in itself, as well as the subjectivity of working with human participants, the studies are therefore reflected upon accordingly. These studies, however, are unanimous in agreeing that active learning and play are highly efficient for the acquisition and retention of information when they are integrated into the classroom under the supervision of a teacher and when ludic activities are derived from the curriculum itself. Therefore, the “teacher will always have to retain control of the curriculum in order to ensure that the learning induced by games is suitably structured. [...] Each game should be part of an articulated programme, with a defined teaching objective. [...] Once a pupil has acquired the zest for a particular subject which comes from a feeling of mastery, he is more likely to want to extend his knowledge, to seek explanations and to revel in the completion

of exercises” (Stott, p. 75). Educational games are therefore more effective when they are administered in the classroom as a means to parallel and enhance the curriculum.

The Alberta Elementary School Science Curriculum stimulates active inquiry by “...providing an initial focus and challenge for learning, by engaging students in developing or adapting a plan of action and by involving students in evaluating results” (Science, 1996, p. A.2). Students acquire their environmental knowledge through a combination of theory and physical involvement – projects range from creating yearlong classroom-based composts to taking trips to the city’s waste management facilities, where students have a chance to experience their textbook learning in a practical way. “By participating in activities and reflecting on the meaning of what they do, students develop the skills of learning how to learn and achieve depth in their understanding” (p. A.2). The curriculum suggests, that “by communicating their questions, observations, discoveries, predictions, and conclusions, [students] can refine and consolidate their learning and identify new connections and avenues to explore” (p. A.2). By uniting to discuss their observations and discoveries, children foster a learning environment for each other, aiding each other’s understanding of the materials and processes, offering advice to their peers on subjects that they themselves understand better and asking for advice on subjects that pose difficulty. Therefore, by helping others to clarify something via scaffolding, children feel empowered knowing that they own and represent the subject matter in a way that is unique to them. It is the intent of all primary education, that the skills developed by students in school will become “skills that [they] apply throughout life”(p. A.2), therefore, if the curriculum offers students a limited skill set based on theory alone, those will be the skills taken by them into the world. Active learning, therefore, encourages not only short-term information acquisition and retention in students, it also provides an additional skill set that could become useful to them in the future.

Much research has been dedicated to the subject of environmental deterioration and preservation, as issues in that field became more apparent and necessary to address; as a result, environmental education started finding its way into the academic curricula in many parts of the world. Beginning with Ehrlich’s controversial 1968 book *The population bomb* and the catastrophic future it projected, environmental awareness rose among the masses, spearheaded by environmental activists and scientists – all publicizing the same message – live sustainably and protect the planet for future generations; “...ecologists, biologists, and many other scientists who believe that we humans have already overstepped ecological boundaries and who urge the reduction of human population and consumption, and the application of appropriate technologies to allow humanity to live sustainably over the longer term as part of a healthy web of life” (Cassils, 2004, p. 186). In his work *Environmental education in the 21st century: Theory, practice, progress and promise* (1998), Palmer thoroughly examines the vast spectrum of global environmental problems, otherwise known as the “grim catalog of environmental deterioration” (DeFries & Silver, 1990, p. 148) including: population growth and its impact on health, agriculture, and economy; extinction and extermination of flora and fauna; human impact on land, water and natural resources; unsustainable and wasteful use of energy leading to rapid climate change; managing waste and hazardous substances; and finally global security and dangerous political and social practices.

These issues “transcend nationality, culture, ideology, and race” (DeFries & Silver, p. 157), thus the authors strongly suggest that the only possible solution to tackling environmental problems would be with collective environmental awareness about the issues. “To transform the essence of Our

Common Future into reality will require broad participation. Every person can make a ‘difference’. Changes are the sum of individual actions based on common goals. A particular challenge goes to youth. More than ever before, we need a new generation – today’s young people – that can use their energy and dedication to transform ideas into reality” (p. 156). Palmer proposes environmental education as the first and most fundamental step in the direction of positive social and environmental change. He examines the transformation of environmental education, as it evolved from nature studies in the 1960s, through fieldwork and conservation education in the 1970s, towards a global shift of values empowering researchers and their research towards the 1990s. Palmer observes a movement trending towards sustainability and collaboration, he advocates for a common goal and a collective solution for the new millennium and beyond. The concept of collaborative awareness that eventually leads to responsible actions is also addressed by DeFries and Silver, who urge that people must make a change in their collective behavior, especially now, when research brings forward more opportunities and possibilities allowing for such changes – “never before in our history have we had so much knowledge, such sophisticated technology, and such wide access to resources. We have an opportunity to break the negative trends of the past” (p. 149).

Environmental experts are in agreement that environmental awareness should be installed at an early age. According to Suzuki, children pick up on negative interactions of their parents with nature and begin to associate nature with fear, growing disconnected from it. He insists that educating young children about the environment should be the primary focus of institutions and governments, and encourages a practical and active involvement of students with environmental matters.

The most critical years, when children are acquiring the attitudes and values that they will use in a lifetime, are kindergarten to grade 4. That is the essential period during which their values are being shaped. So my advice is to pour massive amounts of money and effort into K to 4. Not to give them more computers; I think that’s a big mistake. We ought to be trying in every way to reconnect children with the natural world. [...] And these children will feel much more aware of what the ecological crisis is. (Campbell & Suzuki, 1993, p. 35)

The age range described by Suzuki is an important one for Piaget, Vygotsky, and Montessori. Montessori suggests that “from six to twelve years, [...] children begin to be conscious of right and wrong in terms of their own and other’s actions; a sense of moral consciousness is being formed, which leads to group and social values” (Montessori & Gutek, 2004, p. 55). Piaget’s theory of cognitive development, which was mentioned earlier, begins when a child is born and progresses into their teenage years. The age range from six until approximately eleven [elementary school years] pertains to the stage of *concrete operations*, means children have begun to formulate logical thinking patterns, however when abstract concepts and theories are explained only verbally, they remain problematic for the children to grasp. In order for children to comprehend a concept that is intangible, the concept must be made tangible; a physical, practical experience of the situation or concept is necessary, and hands-on learning is therefore strongly encouraged. Physical interaction between the child and his environment is thoroughly discussed by Vygotsky, who proposes that cognitive development is based on tasks and situations, rather than concrete progressive stages. Vygotsky’s research on the imaginative aspect of play suggests that “action in the imaginative sphere, in an imaginary situation, the creation of voluntary intentions and the formation of real-life plans and volitional motives – all appear in play and make it the highest level of preschool development” (Vygotsky, 1967, p. 26). He discusses how rule-based ludic activity is crucial for the

development of a child's willpower, and places it far above unstructured play. Therefore, implementing learning tools such as educational games into school curricula would not only be entertaining for children – as an alternative to traditional learning – but would also be effective in benefiting their cognitive development and set the foundation for “changes in needs and in consciousness of a much wider nature” (Vygotsky, p. 26).

Designers, anthropologists and sociologists propose that in order for an activity or a learning tool to be effective, it must be enjoyable. In his book *Designing pleasurable products* (2000), Jordan explores the notions of *experience design* and *emotional design*, an approach to creating products that would engage the user on all possible levels of cognition and physicality and would promote pleasure. Jordan bases his theory on the framework of pleasures proposed by Tiger in *The pursuit of pleasure* (1992), where the anthropologist categorizes pleasurable experiences into four types – physical, social, ideological, and psychological. Jordan suggests that in order for an object or process to be enjoyable for the user, it must be designed with the user in mind; centered around and for the user, even involve the user in the design process as an active participant. A learning tool should ideally employ all four of the pleasure senses – the physio-, socio-, psycho-, and ideo-pleasures. An educational game, for instance could stimulate the user on a physical level with its tactile aspect, where the components of the board game such as dice, cards, paper, the board itself, or the character pawns, all require touch in order to be utilized. A game's socio-pleasure would consist of “enjoyment derived from relationships with others” (Jordan, p. 13). This concept is equally applicable to analog, as well as digital or physical games, where even in a digital game the player interacts with the technological platform [computer, television or arcade screen] or other players, if it is an online game. Achieving physio-pleasure with digital games is also possible in a similar fashion, as the player's tactile senses are stimulated by physical movement or by the components of the digital platform [mouse, joystick, etc]. “Ideo-pleasure pertains to people's values [...] the aesthetics of a product and the values that a product embodies. For example, a product made from bio-degradable materials might be seen as embodying the value of environmental responsibility. This, then, would be a potential source of ideo-pleasure to those who are particularly concerned about environmental issues” (Jordan, p. 14).

Psycho-pleasure is related to the usability of a product, and in a game is experienced when the rules and content are designed with the right amount and level of challenge for the player. When the challenges are too simple, the player quickly loses interest, however if the challenges are too complex, the player becomes discouraged or frustrated by not their inability to perform. Therefore, utilizing the four principles of pleasure within a learning tool, could stimulate the user / player / student on all the necessary levels of emotion and experience, thus making the tool or product effective. The psycho-pleasure stemming from balancing difficulty with ease in an activity is also referred to as *flow*, a concept proposed and analyzed by Csikszentmihalyi in his book *Flow: The psychology of optimal experience* (1990). Csikszentmihalyi discusses that *flow* is achieved and “skill development is facilitated when individuals are excited about the task, engage in it primarily in order to master it, and when the task involves an optimal level of challenge (not too difficult which leads to anxiety, not too easy which leads to boredom (Mainemelis & Ronson, 2006, p. 100). Moreover, Csikszentmihalyi suggests that within flow lies the key to highest levels of concentration and information absorption, which mean that a person enters a state of peak or optimal performance, leading to the improvement of skill sets and the advancement of learning. Consequently, creating educational tools that allow the user to experience flow when interacting with them, would require the anatomy, mechanics and aesthetics of the tool

to follow principles of game development, information design, as well as be created with the participation of the intended user.

Druin (2002) follows this philosophy in her written and practical work, as she engages child participants in her research and design of technology. Children take on roles ranging from cooperative inquiry and design suggestions, to co-design and complete immersion into the creation of learning tools – as *users*, *testers*, *informants*, and *design partners* – in order to “shape the technology design process and impact the technologies that are created” (Druin, p. 4). Druin suggests that by including children in the process of creating new technology – such as learning tools and games – they not only influence the final product and outcome, but also learn new skills and information along the way. Furthermore, engaging children in the research and / or design process, requires little alteration of their habitual behaviors and tasks, as children engage in ludic activity voluntarily in their free time anyway. Therefore, “from the child’s standpoint, little needs to change in their day-to-day activities to be included in the [technology] research process” (p. 10). Involving children in the prototyping process has significant advantages to the designer for the following reasons: “children are incredibly honest and at times harsh in their assessments [of technology]” (p. 14); “children have little patience for what they don’t like and they will let technology developers know exactly just that” (p. 14 / 15); and finally, “when a child is in the role of tester, extraordinary amounts of time may not be needed to find initial results” (p. 15), therefore, involving children in the capacity of users, testers, informants, or design partners, can significantly decrease the possibility of “some serious surprises” (p. 15) when the finalized product is given to them for utilization. Participants can offer their input to a research and design process not only verbally and directly, but also indirectly, via observation – “observe children using existing technologies. In this way, design directions may not necessarily be expressed directly by children, but may be implied by their actions” (p. 17).

As previously discussed by Jordan and explored practically by Druin, a tool or process designed for / around the user is best designed with the user’s participation. The level of user involvement in the research and design process can be minimal, where participants are in the role of informants or users of new technology, contributing their opinions on a ready product or tool; when participants take on the role of design partners, their presence in the final product is much more significant, as parts of the visuals, structure, and content of new technology could be created by participants and then directly incorporated into the production process. In *Participant observation: A guide for fieldworkers*, Dewalt and Dewalt (2010) draw attention to the issue of researcher bias, which frequently arises during qualitative methods of data collection and analysis. In order to minimize bias, Dewalt propose researchers place themselves in the mindset of their study participants as much as possible; this step could aid the perception and interpretation of the results, however would not completely eliminate the bias, given the subjective nature and the human factor involved. Adler and Adler (1995) suggest that bias cannot be avoided in data collection that is purely qualitative, unless strict guidelines derived from the data collection process are used from data analysis. Research performed qualitatively is usually based on exploring a subject matter from an open-ended, non-scientific approach; such an approach could be performed and analyzed by itself – when dealing with subjective material, such as visual or emotional data [opinions, pictures, preferences] – or it could be used in combination with quantitative data collection and subsequent analysis, which would involve more tangible and less exploratory information – such as numeric data; overall, “regardless of the type of analysis, the objective is to understand the subject at hand” (Green et al., 2007, p. 545). According to Wildemuth and Zhang, qualitative content analysis is “a valuable alternative to more

traditional quantitative content analysis, when the researcher is working in an interpretive paradigm” (Wildemuth & Zhang, 2009, p. 11).

Qualitative data collection and analysis has often been criticized for its lack of connecting analysis and evidence, “akin to a quantitative study referring to analysis of quantitative data without identifying the type of statistics involved or an explanation of what was calculated” (Green et al., 2007, p. 546). The authors suggest that in order for qualitative researchers to avoid falling into the trap of analyzing and presenting their exploratory data in a vague fashion, four steps of classification of data must be demonstrated: “immersion in the data, coding, creating categories, and the identification of themes” (Green et al., p. 546), however these steps do not necessarily require linearity or chronology.

The goal is to identify important themes or categories within a body of content, and to provide a rich description of the social reality created by those themes / categories as they are lived out in a particular setting. Through careful data preparation, coding, and interpretation, the results of qualitative content analysis can support the development of new theories and models, as well as validating existing theories and providing thick descriptions of particular settings or phenomena. (Wildemuth & Zhang, 2009, p. 11)

Chantavanicht, Chantavanicht, & Fry (1981) undertake three research studies, each to test a theory from “metricians and ethnographers from a broad range of fields and institutions” (Chantavanicht, Chantavanicht, Fry p. 146) concerning qualitative and quantitative data collection. As a result, researchers are advised to merge quantitative and qualitative data collection and analysis techniques, which will provide numerous advantages, “such as more refined and relevant conceptualization, better understanding of residual unexplained variance, more valid empirical indicators, more meaningful interpretation of quantitative data, and finally new theoretical insights.” (Chantavanicht, Chantavanicht, & Fry, p. 155). Overall, both quantitative and qualitative data collection and analysis methods have their specific strengths, which yield results of a different nature; depending on the subject matter that is being explored and the discipline the subject pertains to, a choice of quantitative data analysis could aid in the understanding of the subject from a different perspective compared to the results qualitative data analysis could provide. When dealing with set environments and logically outlined experiments, quantitative data collection and analysis appear to be indispensable measurement tools; however, human participants and exploratory studies are often investigated via qualitative data collection and analysis methods, which allow for a connection to the participants and an observation of their emotional responses and preferences.

Most research studies examined for the purpose of this literature review have been a combination of quantitative and qualitative data collection and analysis, particularly the studies involving children and educational technology. Amory, Naicker, Vincent, & Adams (2002) in their research titled *The use of computer games as an educational tool* opted for a quantitative data collection approach, statistically measuring attitudes and responses of participants based on questionnaires. Their claim of “insufficient pedagogical support in games” is addressed with an effort “to synthesise information on educational games [...] [presenting] a model that attempts to create a dialectic between the pedagogical dimensions and game elements” (Amory et al., p. 318). The researchers collected, visually analyzed, and categorized existing commercial games, creating questions about them based on their play type [strategy, simulation, etc]. Upon completing the testing process, which consisted of administering games to participants and subsequently collecting feedback about the games based on the questionnaires, Amory et al. analyzed the data via a statistical approach. Barab, Dodge, Newell, Squire, and Thomas (2004) practiced a qualitative data collection approach

in *Critical design ethnography: Designing for change*. Their research involved participant observation in the state of “prolonged engagement as participant observer and blurring lines between researcher and researched” (Barab et al., p. 259), in order to create a framework for an instructional design, that would be centered around the user, and involve the user in its research and creation. The process of the project was aimed at facilitating “learning and empowerment [...] [of] children in valuing their communities and in recognizing that they have important ways to contribute to their communities and the world” (p. 255). The first research study created an approach to quantitatively analyzing visual information by creating codes and questions for initially unquantifiable elements; the second research study was flexible and constantly evolving due to its qualitative nature, as researchers were able to let go of “perspectives and goals that were at one point central to [their] agenda in favor of new goals and commitments that revealed themselves as more applicable, meaningful, and useful over time. It is this process of inquiring to understand, critiquing to make better, and designing to instantiate a change into an intervention” (p. 263) that allowed for a successful understanding of the needs and preferences of intended users.

To enrich data collected from participatory workshops during the process of participant contribution, data could be collected into various graphic organizers, such as mood boards, flow charts, and mind maps – or *mental maps* – as Jordan refers to them in *Designing pleasurable products* (2000). Graphic organizers could be exclusively created by the participants, and thus, contain the visual language and content of their choice, or participants could verbally contribute to the creation of the graphic organizers, allowing the researcher or the research facilitators to perform the task of filling out the content. Graphic organizers are explored by Gregory and Parry (1998) as an efficient means to promote flow of associative thinking and increase optimal peak performance, allowing for discovery deep within the mind, creating interesting connections between seemingly disconnected elements and concepts. Moreover, graphic organizers that are used for educational purposes, could be linked to rule-based entertainment or play, and could therefore create a relaxed learning environment, support the learning of new information, and subsequently aid the process of education. As discussed by Vygotsky, rule-based play is more efficient for information acquisition and retention; Csikszentmihalyi concurs, claiming that “control systems in play allow[s] one not only to select an initial optimal balance between challenges and skills, but also to gradually adjust the level of optimal balance so as to continue practicing his or her skills at continuously higher levels of mastery” (Mainemelis & Ronson, 2006, p. 100).

Vygotsky also suggests that knowledge and skills are acquired by children not only through the act of structured play, but particularly so when ludic activity takes place with partners of a similar age range; this is supported by Druin’s observations of her work with children during the creation and evaluation of new technology, and by Montessori’s method of the prepared environment. Thus, the structuralization of play “creates the zone of proximal development of the child. In play a child is always above his average age, above his daily behavior; in play it is as though he were a head taller than himself” (Vygotsky, 1967, p. 25), therefore the *zone of proximal development* [ZPD] theory can be applied to any learning mechanism, for instance an educational game. Retaining the core principles of ZPD – which are based on progressive and assisted learning – could be achieved via the instruction manual of the game and / or the other players who are already familiar with the rules and could therefore perform the scaffolding process, where children take on the roles of adults, coaching and guiding each other through the mechanism and process of the game. Furthermore, because the ZPD of a child is never static – since children are continually evolving

and advancing their skill set by learning and practicing new concepts and techniques – the ZPD theory applied to the design of an educational game could potentially transform the game into a transitional mechanism, where children learn concepts and techniques during play and later apply what they have learned to real life situations.

Moreover, Bruner's proposed modes of *representation* (1967) in the development of children – *enactive*, *iconic*, and *symbolic* – could also be applied to and performed by an educational game. Educational ludic activity could facilitate the learning of new information in a progressive fashion, engaging the players physically, visually and orally. Physical action would involve making moves on the game board, visual engagement could be achieved by observing the imagery and components of the game, and oral engagement would occur by utilizing language, such as reading the instruction cards and asking or answering questions. Moreover, Callois (1958 / 2001) a sociologist and play theorist proposes a classification of games consisting of "four fundamental categories" (Caillois, p. 14), which depend the presence of competition, chance, simulation, or vertigo in any given game; these categories – or rubrics of play – are *agôn*, *alea*, *mimicry*, and *ilinx*. A game dominated by *agôn* is competitive [e.g. chess]; *alea* represents chance-based play [e.g. lottery]; *mimicry* is found in simulation or role-play games, or even stage and screen acting; *ilinx* is a rubric of game typology that is found in physical play, such as sports, and is dominated by the presence of vertigo. Caillois further segments his game typology by locating games along a continuum between *paid'ia* and *ludus*, *paid'ia* representing improvised and spontaneous play that eventually settles down and formalizes into rule-based play, as it reaches *ludus*. As observed previously, *ludus* is the portion of the game continuum where education and academic learning takes place.

Educational games have been researched and tested in numerous studies and settings. Lewis and Repenning in their work *Playing a game: The ecology of designing, building and testing games as educational activities* (2005), propose that a game is not fully capable of being both educational and engaging in equal measure, as "a game can be tremendously engaging without even the slightest hint of learning. On the other hand a game may offer excellent learning opportunities but simply not be much fun to play at all. Certainly the extreme end points need to be avoided but a good balance does not necessarily imply that a game should be exactly in the middle of the continuum" (Lewis & Repenning, p. 2). The researchers thus divide educational games into two design philosophies, *educational design* and *game design*, where educational design promotes play as a response to learning, and game design produces the type of games where leaning takes place as a result of play. When determining which route their game should follow, designers are advised by Lewis and Repenning to "provide sufficient educational background to be able to create educational content that is relevant to K-12 curriculum" (p. 4). Furthermore, in support of Druin's approach of participatory design, Lewis and Repenning recommend that "potential game users are exposed to design prototypes early and often in order for developers to gain insights into the degree of engagement actually achieved by a game" (p. 3). In *Challenges for game designers* (2009), Brathwaite encourages game developers to be attentive to the *metagame dynamic* during playtesting, some examples of which could be "player negotiations, discussion, alliances, online chat, and trash talking" (Brathwaite, 2009, p. 30). In *Rules of play* (2004) Salen and Zimmerman present case studies of four separate game prototype playtesting workshops, exploring participant suggestions and reactions to each game. Therefore, by observing the "...interactions that take place between players outside of the game state" (Brathwaite, p. 30), game developers could factor such information into the materiality, content, and mechanics of their game,

increasing its pleasure factor, and for educational games, their efficacy.

Brathwaite thoroughly explores the process game design, describing the anatomy of games both theoretically and practically. A game developer herself, Brathwaite does not discriminate when discussing various types of play – “digital or non-digital, the underlying fundamentals of a game and therefore of game design are all the same. Though technology may advance, modern video game designers use the same core skills today that were used when designing games on paper” (Brathwaite, 2009, p. 6). *Challenges for game designers* (2009) offers practical exercises for potential game developers, gradually building up the layers of the game design process, beginning with ideation of the ‘core’ and progressing towards prototyping and playtesting. “The ‘core’ or ‘core dynamic’ of a game is the single thing gameplay is about – the single play experience the designer is trying to convey [...] tied to a specific ‘core mechanic’, be it blowing your enemies away, flipping over tiles on your turn, or selling units to another person. These core mechanics can, in turn, lead to ‘core dynamics’, which is a particular pattern of play” (p. 6). Brathwaite segments games into categories of most commonly recurring core dynamics, which are not necessarily mutually exclusive and could appear collectively in various arrangements. The core dynamics are: territorial acquisition [e.g. *Risk*], prediction [e.g. the lottery], spatial reasoning [e.g. *Tetris* or *All Systems Down!*], survival [e.g. *Tag*], destruction [e.g. *Nuclear War*], building [*Sim City*], collection [*Monopoly*], trading [e.g. *Settlers of Catan*], chasing or evading [*Pac-Man*], and race to the end [e.g. *Uno*]. For a game to be successful, core mechanics and dynamics should be referenced continuously throughout the development process; the components of a game – or *game bits* – could reference the core mechanics and dynamics with their materiality and aesthetics, as well as in their content. For instance, game bits such as dice or cards for an environmental board game where the goal is to recycle following the core dynamics of collection and trading, could be made out of environmentally friendly materials [recycled paper and plastic].

When designing visual materials, their aesthetics are important to consider, as “the aesthetic aspect of a design influences the effect this design has on the intended audience, and must therefore be carefully planned” (Frascara, 2004, p. 14). The aesthetic aspect of educational tools is particularly important, given that their function is to promote interest in a subject, as well as to increase knowledge and encourage further learning. An educational tool is usually a combination of content and visuals; therefore, it could be categorized along the branch of information design, and created in agreement with the principles and techniques of visualizing information. According to Tufte in *The visual display of quantitative information* (1983), “what is to be sought in designs for the display of information is the clear portrayal of complexity” (Tufte, p. 191), which is possible to achieve by simplifying and reducing graphic elements into understandable forms, as well as utilizing the power of color sparingly, because generally “the mind’s eye does not readily give a visual ordering to colors, except possibly for red to reflect higher levels [of visual and content hierarchy] than other colors” (p. 154). Furthermore, Tufte differentiates graphics into two categories – *friendly* and *unfriendly* – suggesting various techniques and specialties of friendly graphics that could be employed in order to achieve success in displaying information. Tufte recommends to repeat graphical elements so as to clarify the content they represent, and Clark and Lyons discuss this further in *Graphics for learning: Proven guidelines for planning, designing, and evaluating visuals in training materials* (2011), where they suggest that repetition of simplified graphical elements stimulates short-term memorization and subsequently triggers associations and prior knowledge that is stored in the long-term memory. Clark and Lyons also explore various applications and mediums of educational graphics, concurring with Tufte

that “if the nature of the data suggests the shape of the graphic, follow that suggestion” (Tufte, p. 190) and that “graphics should be as intelligent and sophisticated as the accompanying text” (p. 137).

Given that educational graphics usually have a strong presence of text, typography becomes a necessary consideration and component of the design process.

Typography is, by and large, an art of framing, a form designed to melt away as it yields itself to content. Designers focus much of their energy on margins, edges, and empty spaces, elements that oscillate between present and absent, visible and invisible. (Lupton, 2004, p. 115)

Studies on the effectiveness of typefaces and type layout have been performed in numerous settings, exploring legibility, readability, and overall functionality of type. Specific suggestions have been made regarding the use of typography, depending on the target audience of the product, as well as the purpose of the product itself; however, fundamental typographic standards and classic principles of typography, which are thoroughly explored in the works of Lupton (2004) and Kane (2003), are recommended to be applied to new design situations wherever possible. “Because reading is a physical act, the first goal of designing text is to make the experience pleasurable” (Kane, p. 118); this could be achieved by “careful consideration being given to the use of the interacting variables of type size, line length and space between the lines” (Reynolds & Walker, 2002 / 2003, p. 119). Achieving optimal reading experience in educational materials could also be done by acknowledging the preferences and opinions of the user, for instance “educational publishers often produce their own infant characters to conform to the view of many teachers that letters for reading should be similar to letters for writing” (p. 106). Sassoon (2000) has amassed a body of research regarding educational technology and from it she created the *Sassoon Primary* typeface, which was based specifically on children’s reading and writing preference, reflecting handwritten letterforms and thus flowing smoothly and naturally. Consequently, during the design of an educational tool, a strategic combination of graphic elements could lead to a potentially effective outcome, where the educational tool is not only aesthetically pleasing, but also helpful in encouraging information acquisition and retention.

To summarize the main points of this literature review, it could be proposed that an educational tool could be considered potentially effective for promoting interest in subject matter, if:

- it combines structured ludic activity that has been explored and co-created with the participation of the intended user;
- it has been researched and analyzed via a mixed-methods approach;
- it was designed around a curriculum or a set of pedagogical materials, as well as the educational topic it is addressing;
- it adheres to principles of play;
- it adheres to, explores, and utilizes the principles of user centered and information design.

DATA COLLECTION

After determining the research question and reviewing the literature in order to understand the subject areas pertaining to the research question, data was collected and analyzed. This consequently led to the creation of the *Planet Play* prototype. The following steps were accomplished:

1. A three-stage visual analysis of existing environmental games was designed and analyzed.
2. Two workshops were planned with child participants from a fourth grade of an elementary school in Edmonton, Alberta.
3. Materials were designed for the first workshop, which would consist of four parts, and assess the children's existing awareness of environmental issues, as well as their interaction with and attitude towards the four environmental board games that were selected from the visual analysis.
4. The first workshop was conducted and information gathered during the process was evaluated in consistency with the literature and the visual analysis.
5. The *Planet Play* prototype was designed based on the data analysis from the first workshop.
6. The second workshop was conducted, where the *Planet Play* prototype was tested and feedback on it was collected in a manner that paralleled the first workshop.
7. The feedback from the second workshop was analyzed; changes, suggestions and limitations were noted and discussed.
8. The prototype of *Planet Play* was refined according to the recommendations of research participants and a visual display of the design research process was created.

For data visualization, please see Appendices, Visual Analysis, Matrix Diagrams, Research Question.

Overview

Based on the literature review and the findings regarding child development, game design, participatory research and environmental preservation suggestions, the game market was explored in search of various types of educational and environmental games that are available today. The focus of this design research became tabletop [or analog] games, specifically board and card games, which could be used in a classroom as a supplementary teaching tool. Even though an educational game could easily take any form – such as physical, digital, or analog – it is particularly tabletop games that were chosen for their familiarity, materiality, and the physical involvement of players with the game. Digital games are rapidly upgrading, changing to keep up with the digital world and completely depend on progressive technological inventions like screens and electricity, whereas an analog game could be played in a camping tent today or in many years the same way it could have been played in the living room of a family home decades ago.

Once the area of research interest was selected and environmental awareness and educational games became the essential subjects to explore, it was necessary to understand game anatomy and all the things that go on during the development of a game – everything from form [materiality], to content, to function [mechanics]. Furthermore, by combining environmental awareness with educational games, environmentally themed or eco games became the branch of gaming to explore; consequently, the contemporary game market was evaluated in order to discover and understand the design and content trends that were occurring among existing environmental games. Determining the trends of materiality, content, and mechanics of the games, could open possibilities of implementing aspects of these trends into the anatomy of my own game prototype. Thus, a big part of my research consisted of finding, documenting, and visually analyzing existing environmentally educational games. 30 games were selected – for reasons discussed in stage 1 of the visual analysis – from the large variety of available educational environmental games. Considering that all environmental games share certain commonalities and overlaps, yet also differ from each other, it was necessary to somehow first identify and then compare these differences and similarities in a coherent organized fashion, for which a visual analysis was conducted.

The visual analysis was segmented into three stages and created throughout the course of my research. Briefly, the first stage of the visual analysis consisted of collecting all sorts of environmentally themed games and observing them for general trends pertaining to game anatomy. The second stage of the visual analysis consisted of filtering through the results of the first stage, while simultaneously narrowing the focus onto the category of tabletop games. The third stage of the visual analysis was to select four of the previously examined tabletop games, and explore them in further detail, in order to apply information about the games towards the preparation of testing materials that would be used during the first workshop.

The first workshop was conducted with a group of 30 child participants and was followed by an analysis of the data gathered during the process. The analyzed data was then applied towards the design of the *Planet Play* game prototype. The prototype was tested during the second workshop, with the same participants, and the observations and reflections gathered from the field were analyzed and documented. The feedback and suggestions, which came from participants about the game prototype, were discussed and the prototype refined. What follows is a detailed look into the general structure and flow of my research and data collection process, consisting of the three stages of a visual analysis of existing games, the description and analysis of the workshops, as well as the design, testing,

and discussion of the *Planet Play* prototype.

For data visualization, please see Appendices, Visual Analysis, Matrix Diagrams, Data collection & data analysis process.

Visual Analysis: Stages 1-3

The visual analysis was designed in a narrowing style, much like a filter that progressively became finer with each of its stages. The first stage looked at a broad spectrum of environmental games, aiming to mainly determine their type, basic anatomy, and materiality; the games were not examined in depth during the first stage, but as an overview of the overall availability of various types of environmentally themed recreation present today. General questions [see *Appendix, Visual Analysis, Matrix Diagrams, Stage 1*] were created and applied to all 30 games, aiming to recognize primary structural and thematic commonalities and differences between them. During the second stage of the visual analysis, all games from stage 1 were filtered to contain exclusively tabletop games; general information about the basic structure of these ten games was re-established and further focus was directed towards understanding and comparing their educational content. The aim of my research question was to design an educational environmental game, therefore stage 1 of the visual analysis joined together games that all shared an environmental theme. Consequently, it was necessary to fashion stage 2 in a manner such that the educational value of the games could be addressed. In view of the highly subjective nature of measuring something as intangible as the level or value of educational content, a simple system was devised, following a structure similar to the one in the first stage of the visual analysis. Questions were created [see *Appendix, Visual Analysis, Matrix Diagrams, Stage 2*] and applied to each of the ten tabletop games. The content of the questions was based on the concepts each game contained, such as flora, fauna, or urbanization, as well as the levels of its realism and contemporaneity; therefore, information about each game was evaluated and then segmented into themes / trends.

Once the levels and diversity of educational content in the ten tabletop games were established, a further filter was applied to them during stage 2 of the visual analysis. Ten games were reduced to only four, with a more in-depth focus on comparing them to each other and examining their mechanics and structure. If the first stage of the visual analysis introduced the environmental features of the games and the second stage was more concerned with their educational elements, then the third stage of the visual analysis focused primarily on the design aspect of environmentally educational games. Consequently, the games *Bioviva*, *Eco Squad*, *Eco Fluxx*, and *Earthopoly* were all cross-referenced against a set of questions [see *Appendix, Visual Analysis, Matrix Diagrams, Stage 3*] inside a matrix diagram, similar to the matrix diagrams from the first two stages of the visual analysis. The four games were analyzed for similarities and differences between their play structures; the speed of play, the winning conditions, as well as the content and components were compared. Stage 3 of the visual analysis was the last non-participatory data collection stage of the design research, right before conducting the first workshop with the child participants. The third stage directly affected the design of the workshop materials, which were created and used for the practical data collection phase, with the four games [*Bioviva*, *Eco Squad*, *Eco Fluxx*, and *Earthopoly*] being a crucial data collection tool in of themselves.

Workshop 1

The first workshop consisted of four parts. The first two parts were structured to gauge the participants' understanding, knowledge, and awareness of environmental terms, issues, and preservation techniques. The second half of the workshop observed child participants, as they were segmented into four groups, where each group played one of the four games that were

selected for them by the filtering mechanism of the visual analysis. A feedback session followed the game-playing portion of the workshop.

All four stages of the first workshop were evaluated in a manner similar to the visual analysis of existing games. Two sets of questions [see *Appendix, Visual Analysis, Question Card Questions*] and matrices were created for the data gathered during the workshop, one set of questions about the graphic organizers [question cards, mind maps] that were used in the workshop to collect data from participants, and one set of questions about *Bioviva*, *Eco Squad*, *Eco Fluxx*, and *Earthopoly*, which participants played. Similar to the three stages of the visual analysis, workshop observations of participants and their feedback were analyzed for trends that represented preferences.

Prototype

The trends gathered from the first workshop were combined into one game, which became the prototype of *Planet Play*. The design of the prototype consisted of creating the game's core, mechanics, and components. Being a board game, *Planet Play* was structured around the core dynamic of collection and a question / answer trivia approach; all question were based on the literature, specifically the Elementary School Science curriculum of the province of Alberta, as well as on the content derived from *Bioviva*, *EcoSquad*, *Eco Fluxx*, and *Earthopoly*. The materiality, content, and mechanics of *Planet Play* were a combination of the most favored elements of the materiality, content, and mechanics of *Bioviva*, *EcoSquad*, *Eco Fluxx*, and *Earthopoly*, as seen from the responses of participants during the first workshop. *Planet Play* consisted of a board, dice, question cards, eco effort cards, eco points or *ecos*, goal cards, and character passports; three almost identical prototypes of the game were created.

Workshop 2

A second workshop followed shortly, where *Planet Play* was tested with child participants and feedback about it was gathered using the same feedback collection techniques as during workshop 1. A set of questions [see *Appendix, Workshop 2*] was created, similar to the questions from workshop 1, where participants were asked about their preferences, opinions, and suggestions regarding *Planet Play*. The feedback was evaluated in the same fashion as the data gathered during the first workshop; the only additional factor was in regard to the suggestions and changes that were necessary to be made in order to refine the prototype. A combination of the participants' experiences playing *Planet Play* with my own observations of the miss-steps and glitches of the design and play proceedings were all noted and discussed in the Prototype Analysis section of this document.

The research process began with a visual analysis of 30 games, chosen from a wide selection of educational games, all of which were environmentally themed; it ended with only one game, *Planet Play*, which was the result of continuously narrowing the selection of existing environmental games, leaving behind most of them and focusing on the ones that demonstrated the highest educational, environmental, and entertaining diversity. The visual analysis process was created and documented inside matrix diagrams and interpreted as trends derived from re-occurring elements of game design anatomy.

VISUAL ANALYSIS

Below is a detailed description of the three stages of the visual analysis.

For data visualization, please see Appendices, Visual Analysis, Matrix Diagrams, Stage 1.

STAGE 1

The first stage of the visual analysis explores three types of games – tabletop, digital, and physical. The categories of games were chosen based on the literature concerning game development, particularly the work of Brathwaite, Salen, and Zimmerman, upon which the games were found online and in education libraries. Visual examples of the different categories of tabletop, digital, and physical games that are mentioned below can be found in Appendices, Visual Analysis, Game Images. Tabletop games span a broad spectrum of games: board, card, role-play [which is considered by some classification systems to be an independent genre / type], tile-based, and pen & paper games; additionally, there are variations of dice-only games as well as numerous building games, neither of which necessarily require a tabletop to be played on, yet are still housed under the roof of the same spectrum of tabletop games. Digital games can be categorized based on the device or source they are intended to be played on, as well as their different genres. Stage 1 of the visual analysis explores three main categories of device-based digital games, which are computer, arcade, and video. For the purpose of my research, I did not segment digital games into the common genres used for defining them, such as first person shooter or maze or strategy, etc. This was an intentional step, considering that the primary focus was on tabletop games, therefore with digital games, it was necessary to merely establish whether they have structural similarities to analog ones; the same rationale was applied to physical games. Moreover, a large portion of digital games are based on the core dynamics of either survival or destruction, both of which are areas of play that present no interest to me, nor use to my research question. Therefore, digital games were characterized based on their device / play source [computer, arcade, video]. Finally, the physical games, which I looked at in the first stage of my visual analysis were either indoor or outdoor games, and shared a common similarity of being non-sedentary and requiring movement. Naturally, there were overlaps between all three of these categories, for instance a game that was designed to be digital, could have been structured as an adventure or quest, which was a dynamic that was also present in both tabletop and physical games.

The only constant similarity between all of the games within the visual analysis was the theme of environment and environmental preservation. The visual analysis examines 30 games that all have an environmental focus and categorizes them based on the type, materiality, and mechanics of each game, as well as the skills necessary to play them [see *Appendix, Visual Analysis, Matrix Diagrams, Stage 1*]. Out of the 30 games that were chosen for stage 1 of the visual analysis, there were ten games in each of the three categories – tabletop, digital, physical. The reasoning behind the quantity of the games was the following:

- ten games was a number large enough to produce trends among individual categories. Naturally, even looking at three games could potentially yield a certain repetition of common trends; yet throughout the research process I desired a more in-depth look

at the overall game selection, so as to increase the trend diversity projected by the matrix and also to familiarize myself with as many types of currently available games as possible during the process;

- ten games was a number small enough to locate a sufficient minimum of games for. In other words, throughout the process of searching for existing games, it was feasible to locate a lot more environmentally themed games that were in digital format, as opposed to games in analog, or above all, physical formats. Furthermore, in the process of browsing the game market, ten games became a tentative number that was considered to be tested with participants. This number later decreased due to a number of factors ranging from the impossibility of obtaining an adequate amount of time to test this many games, a sufficient number of participants available to collaborate with for testing all ten, and finally the actual acquisition of the games into my physical possession, as not all of them were available for purchase.

Upon locating the necessary assortment of games, a repetition [or trends] in certain similarities and differences among them was explored, so as to gain insight into the general anatomy of environmental games. In order to observe trends among the games, questions revolving around the basic principles of game structure were created, based mainly on Brenda Brathwaite's *Challenges for game designers* and *Rules of play: Game design fundamentals* by Katie Salen and Eric Zimmerman*.

The questions for stage 1 of the visual analysis were structured within either a yes/no format or along a range from lowest to highest; some questions also allowed for short written descriptions. The questions were identically applied to all of the games, therefore each of the 30 games was evaluated and analyzed consistently. By juxtaposing the games with the visual analysis questions, a matrix was created, where all games were arranged in the top horizontal row, along the x-axis and all the questions about them in the vertical row along the y-axis [see *Appendix, Visual Analysis, Matrix Diagrams, Stage 1*]. By applying the same question to all of the games, it became possible to observe themes that were common among the 30 games, whether the games were analog, digital, or physical in nature. A list of questions and games can be found in the Appendices. Below is a discussion of the trends projected by the first matrix diagram.

Materiality & Technical Specifications

Out of the tabletop games, board games occurred most frequently; card games and trivia games were a close second, however there were no pencil & paper games, and only one tile-based game [*Catan Scenarios*]. Even though all ten of the digital games could be adapted for play on any digital platform, 50 percent of the digital games were made for the computer; the rest of the digital games were fairly equally distributed between arcade and video. Finally, physical games were evenly balanced between indoor and outdoor games; in most cases, the games could be played in either environment.

All ten tabletop games required a payment, within a price range between approximately five and sixty dollars; this is an expected trend, as the games have physical components that require manufacturing; card games were the cheapest, due to the simplicity of their components [cheapest: *Eco Squad*], board games were the most expensive from the tabletop game category [priciest: *Bioviva* and *Catan Scenarios*].

VOTE *Questions included in the further stages of the visual analysis, as well as parts of the data collection materials for both of my workshops were all also designed based on the information and recommendations found in these two great books.

Digital games built with Adobe Flash™ were almost always free of charge [e.g. *Eco Ego*]; if a digital game required payment, there was always an opportunity of a one-hour free trial [e.g. *Eco Match*]. Physical games were all free of charge, excluding the components necessary for the games, such as paper [e.g. *Who am I?*], thread [e.g. *Animal Consequences*], or other basic objects. Most of the tabletop and physical games were marketed and described as educational; 50 percent of the digital games were specifically labeled as educational and categorized on various websites under the learning section. The date of creation of most tabletop games was between mid-1990's and late 2010, however *Dirty Water* was an older game, designed in the 1970s. Given their medium, the digital games were almost exclusively made past the year 2000, however some of the user interfaces were aesthetically aged to appear as retro arcade games from the early 1980's [e.g. *Greenpeace Eco Quest*]. The date of creation of the physical games was not possible to determine, given their timeless and universal nature, however only one game presented the date of the game's official creation in its title [*1926 Park Adventurers*].

Time allocated for completing the tabletop games from start until a winner emerged, ranged between ten minutes and two hours; card games like *Eco Fluxx* and *Eco Squad* required the shortest amount of time to finish, *Earthopoly* and *Catan Scenarios* were more complex and therefore required the longest time to play. Digital games were designed around a less flexible time frame, given the presence of preset levels, therefore to complete one level or challenge, the time requirement varied between ten minutes and a few hours. The multitude of levels in some digital games also allowed the game to be played for days, if the player so desired. The time frame and duration of the physical games were the most open-ended and arbitrary, as well as flexible; the players could include time into the game as a game constraint, and they could also play each game without a time constraint, in both cases not changing the overall flow of their play. *Robbers* and *Habitat Musical Chairs* were the only two physical games that were somewhat dependant on a set time frame, which could also be increased or decreased if necessary.

Every single tabletop game was intended to be played with at least two players or in teams; therefore no game was a single-player game. Digital games were the opposite; all of them designed as individualistic one-player games. Physical games were very flexible and allowed for as few as one player and as many as large groups. In digital single-player games, avatars or characters were common, where the player would assume an identity and play as that character [e.g. *Eco Ego*]. Tabletop games did not provide specific character avatars to players, however board games containing character pawns in their game bits could be considered as player identities [e.g. shell, wood block]. Some of the physical games specifically required players to assume identities – animals, plants, or explorers – however 50 percent of the physical games were intended for players as themselves.

Skill

Out of 30 games, 21 were intended for a mixed target audience – children and adults – and only one game was directed exclusively at adults [*BBC Climate Challenge*]; seven games were aimed at children, which was clear from their descriptions, as well as upon examining the mechanics and dynamics of each game. Removing the human factor out of this analysis [for the unexpected outcomes it always brings out in games], the trend projected by the matrix regarding levels and structure of each game was that 23 games were created with pre-determined levels or along a ready structure. *Eco Fluxx* and *Catan Scenarios* were the only games, which were designed with the dynamic of unpredictability and continuous fluctuation of outcomes integrated into their game components, therefore their levels

and play structure could never be static. The amount of unpredictability decreased around digital games, which not only had a set user interface, but were also programmed with a finite number of game outcomes, which is something that could never occur in physical games. Tabletop games also displayed a prepared nature of their user interface, similarly to digital games, however were also alike with physical games in the sense of their play structure. Overall, only digital games were solidly structured with prepared outcomes, whereas physical and tabletop games followed the philosophy of ‘your can never walk into the same river twice’, offering a different state of play each time.

The speed or pace of the games was evenly divided between tabletop and digital games, with most tabletop games being slow-paced and most digital games fast-paced. Similarly to the trend of digital games dominating with predetermined levels and a set game structure, the pace of these games and time frame allocated to playing them was also fixed in most cases; some games operated along a chase to the end core dynamic, therefore both the speed of play and the time allowed for achieving the set goal were crucial elements [e.g. *Tweety’s Ocean Cleaning*, *Landfill Bill*, *Eco Ego*]. The slowest paced digital games were *BBC Climate Challenge* and *Word Power*, the former consisting of making political and ecological decisions for a country over the span of 100 years, and the latter could be described as an ecological merge between digital *Scrabble* and *Book Worm*. The fastest paced tabletop game was *Eco-Fluxx*, requiring players to think and act quickly in order to stay in the game. *Nature Balance* and *Robbers* were the fastest paced physical games, and could be compared to a hybrid of *Tag* with *Hide-and-Seek*, requiring players to run and collect hidden items [chasing and evading dynamic].

Mechanics

Tabletop games were overall heavily dominated by the dynamic of race to the end, requiring players to either be the first to finish the game [e.g. *Eco Planet*] or the last to remain in the game [e.g. *Earthopoly*]. The dynamics of collection and strategy were also strongly present in the tabletop games, with 80 percent of the games displaying both dynamics. Prediction or guessing, as well as question-answer type trivia dynamics were secondary in tabletop games, however still dominated when compared with digital or physical games. Tabletop games did not display any presence of the dynamics of survival, chasing / evading, or quest and adventure. Digital Games, on the other hand, were dominated by the dynamic of survival [in a non-violent sense], as well as by the dynamic of collection [60 percent of the games]. A close secondary dynamic was strategy [50 percent], followed by prediction and guessing, as well as chasing / evading [both 40 percent]. There was no dynamic of territorial acquisition in digital or physical games; furthermore, physical games displayed the most balanced dispersion of play dynamics, without a strong domination of any particular one. Once again, collection and strategy appeared to occur more frequently than other game dynamics, and physical games displayed no presence at all of mercantile game dynamics such a buying / selling / trading, which were both occurring in three out of ten games, both tabletop and digital.

Overall, the most frequently occurring core dynamics between all 30 games were race to the end, collection, and strategy. Therefore, such a game could involve players strategically collecting the most of something [points, tokens, recyclable garbage, nuts, etc.], all within a set time frame or on a first-to-the-finish-line principle.

The dynamics of prediction and guessing, survival, or trivia [question-answer] were dispersed among the games as well, and are therefore counted as secondary dynamic trends. The least occurring core dynamic among the

30 environmental games was the dynamic of territorial acquisition; only *Earthopoly* and *Settlers of Catan* were designed around the mechanic of players acquiring territories in order to win, however this dynamic is similar to that of collection, which was among the top recurring among the games. All the data described above could be found in Appendices, Visual Analysis, Matrix Diagrams, Stage 1.

Finally, not having officially included in the matrix, yet still having analyzed the language component of any of the 30, a general observation regarding the subject would be: the tabletop games all have a text base and therefore the language component is strongly present, requiring the games to be played in the language they were designed for. From the ten digital games, nine are accessible in any language, given the rules are explained to the player in advance; *BBC Climate Challenge* is the only game which is heavily dominated by text and is by and large quite difficult to follow without being familiar with basic politics and economics [the game is clearly targeting adults, or at least older teenagers, and would not appear to be suitable for children]. The physical games were mostly independent of a language component, as they required exploration and physical action; however, verbal descriptions were a necessity for three games [*Animal Consequences*, *Habitat Damage Musical Chairs*, and *Animal Charades*].

Summary of Trends, Stage 1

The information discussed in stage 1 of the visual analysis is summarized below.

- The most frequently occurring environmental games were board games, computer games, and a balance between indoor and outdoor games.
- Tabletop games all required payment [5-60 dollars]; digital games, which were not free of charge, offered free trials; all physical games were free of charge aside from basic household items that were intended as game components.
- The games were mostly marketed and described as educational, particularly all tabletop and physical games; digital games were not always labeled as educational, but always as environmental.
- Date of creation: Tabletop and digital were created mostly in the 1990's and later; physical games could not be assessed regarding the date of their creation, given their almost folkloric nature.
- Set levels, game structure, and play outcomes were only present in digital games, due to their pre-programmed game system.
- There was an even distribution of play speed among the 30 games; most tabletop games were slow-paced, most digital games were fast-paced. The pace of physical games could be altered according to the preferences of players.
- A mixed target audience consisting of both children and adults could play 29 out of 30 games; only one game was aimed specifically at adults.
- The duration of the games was open-ended for physical games and most digital games [except the games that were designed around a specific time frame]. To play the tabletop games from start to completion a range between ten minutes and two hours was necessary, depending on the game.

- Most frequently occurring core dynamics: race to the end, collection, strategy.
- Moderately occurring core dynamic: prediction / guessing, survival, trivia [question-answer].
- Least frequently occurring core dynamic: territorial acquisition.

As mentioned previously, upon gathering general information about environmental games pertaining to three different types of play, tabletop games became the focus of the second stage of the visual analysis.

STAGE 2

In the second stage of the visual analysis, a matrix similar to the one in stage 1 was created to explore the tabletop game category in more detail. Having established the trends for environmental games, such as the most and least frequently occurring game dynamics, the duration and target audience of the game, the overall goal and winning conditions, ten tabletop games were isolated and then examined for presence and levels of educational content.

For data visualization, please see Appendices, Visual Analysis, Matrix Diagrams, Stage 2.

Content

Out of the ten tabletop games, the most frequently recurring content theme was that of environmental preservation techniques, with six out of ten games focusing the game dynamic around it or incorporating environmental preservation techniques into their components [*Earthopoly*, *Eco Squad*, *Catan Scenarios*, *Dirty Water*, *R-Eco*, *Terra*]. Environmental threats and dangers dominated the content of 50 percent of the games; the games would either begin with an environmentally threatening situation [*Dirty Water*, *Eco Squad*] or there would be a build up towards either saving resources or damaging the environment [*Catan Scenarios*, *R-Eco*, *Terra*]. Only three out of ten games focused exclusively on flora and fauna, with the themes of animals, plants, and their natural habitats directing the trivia of the game [*Eco Fuxx*, *Dirty Water*, *20 Questions*], however as later seen in the workshops with participants, the trends of flora and fauna were most appreciated and enjoyed when compared to the other categories of environmental content. Natural resources – such as water, energy, and fossil fuels – were not common at all, frequently occurring in only *Earthopoly* and *Catan Scenarios*, however *20 Questions* and *Eco Squad* also briefly mentioned these subject areas. Finally, out of the ten tabletop games, the most balance and well-rounded representation of all environmental issues was displayed by *Bioviva*, and *Eco Planet*; both games were structured differently – *Bioviva* was more of a strategy trivia game and *Eco Planet* operated with the use of race to the end and cards – however in their respective dynamics, both games appeared to contain a diversity of environmental trivia.

As mentioned in stage 1, all tabletop games were intended to be played with at least two players or in teams. The minimum number of players was two, allowing players to ask and answer questions where there was a question component [*Bioviva*, *Eco Squad*, *Dirty Water*, *Eco Planet*, *20 Questions*]. The maximum number of players was ten, however most games were recommended to be played with four players, as indicated by the research process. All ten games were based on players representing themselves during play, without avatars. However, as discussed further in stage 3, the board games [*Earthopoly*, *Bioviva*, *Dirty Water*, *Eco Planet*, and *20 Questions*] were all designed with character pawns or tokens, which

players moved around the game boards as they progressed. The board games *Catan Scenarios* and *Terra* and the card game *R-Eco* were designed with tokens that players would locate on the game surface throughout the course of playing the game.

There was an even distribution of reward systems between the ten games, with *Earthopoly* and *Dirty Water* rewarding the player with play money and *Bioviva*, *Catan Scenarios*, *R-Eco*, and *Terra* rewarding the player with tokens or points. *Eco Squad*'s reward system was to solve as many environmental problems as possible – which was indicated by amassing cards – and *Eco Fluxx* operated in the opposite direction, requiring players to rid themselves of cards throughout the process of the game. *Eco Planet* and *20 Questions* both rewarded the player by allowing the player to advance along the game board upon answering an environmental question correctly. The reward system of environmental games is further discussed in the Prototype Analysis and Limitations section of this document.

The tabletop games portrayed planet Earth with a balance between real, imaginary, and abstract imagery; real depictions such as those in *Eco Squad* and partially in *Earthopoly*, were achieved with the use of photography; there was no overview or bird's eye portrayal of the Earth, however localized places or objects were shown, and will be discussed in stage 3. *Bioviva* and *Terra* were created with a similar visual approach, where the Earth was illustrated from a bird's eye perspective, with *Bioviva* providing a much more detailed focus on the world's continents and their diverse climates; comparatively, *Earthopoly* – which used a combination of photography and illustration – and *Terra* depicted the earth and the continents in a more abstract and much less detailed manner. Card games like *Eco Fluxx* and *R-Eco* illustrated various animals, plants, and objects, making these games realistic yet localized in content. *Dirty Water* and *Catan Scenarios* used representations of imaginary game worlds on their game boards, which were illustrated – *Catan Scenarios* more realistically than *Dirty Water*, which used the technique of simple and playful illustration. Finally, *Eco Planet* and *20 Questions* were both travel and destination games; the *Eco Planet* world was a combination of photography and illustration, much like *Earthopoly*, and *20 Questions* appeared to have the least similarities with any other games, showcasing an abstract game board, with the game road in the shape of a large question mark.

The time periods which the games were set in were abstract in 50 percent of the cases, with varied levels of realism and recognizability; *Earthopoly* was the most realistic out of the abstract games and *20 Questions* was the most abstract [*Eco Fluxx*, *Dirty Water*, and *Eco Planet* were along the continuum, with the order open to subjective judgment, depending on the perception and expectations of the player]. *Catan Scenarios* was inviting players into a world where an oil expansion was taking place on the island of Catan; the game follows a Euro-game structure of strategy and its visual language could be described as historical and imaginary. Finally, *Bioviva*, *Eco Squad*, *R-Eco*, and *Terra* were all set in contemporary reality, addressing current issues both with their content and the visual language used in designing the components.

Mechanics

As discussed in stage 1, tabletop games were dominated by the dynamic of race to the end, which required players to either finish the game first [e.g. *Eco Planet*] or remain in the game longer than the other players [e.g. *Earthopoly*]. *Bioviva*, *Eco Squad*, *Catan Scenarios*, *Dirty Water*, *R-Eco*, and *Terra* all demonstrated the race to the end dynamic, with a focus on collection [*Earthopoly*, *Bioviva*, *Catan Scenarios*, *Dirty Water*, *R-Eco* and *Terra*] and strategy [*Eco Squad*, *Catan Scenarios*, *Dirty Water*]. Trivia-based

game dynamics – prediction, guessing, and question-answer – occurred with a moderate frequency and were present in *Bioviva*, *Eco Squad*, *Eco Planet*, and *20 Questions*. There was a dynamic of cause and effect situations, where the players actions would directly lead to a certain outcome; *Eco Squad* demonstrated an open-ended cause and effect dynamic, offering players the chance to solve environmental problems with eco-friendly solutions. *Catan Scenarios* began with the premise of oil discovery on the island of Catan and the goal of using the oil in order to advance the infrastructure of the island; as an effect to the actions of the players, natural resources and habitats would become polluted. Such was also the case with *Dirty Water* and *Terra*, where a balance was meant to be kept between using up resources in order to advance in the game and preserving resources in order to protect the game world. Therefore, a dynamic of balancing progress with devastation was present in *Catan Scenarios*, *Dirty Water*, and *Terra*.

Eco Squad, *Catan Scenarios*, and *Dirty Water* were all games where strategy dominated chance or luck, and the winning outcomes of the games could be reached depending on the strategic planning of each move. As discussed in the literature, games that are purely strategic and do not rely on luck – such as chess or Euro-games, like *Settlers of Catan* – are not suitable for young children, because children will lose focus and interest when they do not know certain trivia or cannot take logical and calculated steps that would advance them in the game. Game theorists discuss that children playing games that are completely luck or chance based – and do not involve premeditated moves – are still considered to be planned and strategic by the children, who attribute luck of the draw or a favorable roll of a dice to their own abilities and not to probability and chance. Therefore, games operating around the dynamic of luck and chance are generally designed for the younger demographic. In this visual analysis, out of the ten tabletop games, *Eco Planet* and *20 Questions* were the only games that could possibly resemble such a dynamic, however only if the luck or chance of being given a certain type of question is considered. Otherwise, *Eco Planet*, *20 Questions*, *Earthopoly*, *Bioviva*, *Eco Fluxx*, *R-Eco*, and *Terra* were all games that displayed a balance between luck and strategy. As will be discussed in stage 3, *Earthopoly*, *Bioviva*, *Eco Fluxx*, and *Eco Squad* were selected to be taken to child participants; these four games contained a variety of degrees pertaining to chance and strategy, and were therefore interesting to explore so as to understand the preferences of the child participants.

Finally, none of the tabletop games explored the dynamics of a collective win – where if one player reaches the winning outcome of the game, all players automatically follow suit – however *Terra* and *Catan Scenarios* did allude to a collective loss, consisting of all players reaching a negative outcome in the case of continuous irresponsible environmental actions from one player. However, it was impossible to judge the effectiveness of this dynamic with child participants, as neither game was chosen to be included in the game workshop.

In terms of materiality, all ten tabletop games were visually different, having few compositional similarities between them. Naturally, card games – given their medium – were similar to each other, with *Eco Fluxx*, *Eco Squad*, and *R-Eco* displaying various styles of information design and graphic element arrangement. *R-Eco* was the simplest in terms of its visual language, utilizing imagery conservatively and negative space generously. *Eco Fluxx* was very cluttered with text, as part of the game's dynamic was reading and following instructions, thus developing focus and attentiveness; the illustrations were almost encyclopedic and very detailed, which was one of the reasons the game was selected to be part of the workshop with participants. As mentioned earlier in this section – and will be discussed in detail in section 3 – *Eco Squad* utilized a combination of photography and illustration and

was selected partially for that reason. Furthermore, *Eco Squad* along with *Bioviva* were the most unique games – visually, materially, and in content – out of the ten tabletop games explored in the analysis. *Bioviva* was very clear and coherent in its layout and components, much like *Terra*, yet with deeper and more diverse presence of environmental information. Most board games did not appear to share much in common with other board games, aside from the presence of a game board among their game bits.

There were also certain rule similarities between the ten games. *Catan Scenarios*, *Dirty Water*, and *20 Questions* shared most rule similarities between them and among other games, thus making these three games more diverse and adaptable to a larger demographic of players. This would simultaneously reduce the uniqueness of *Catan Scenarios*, *Dirty Water*, and *20 Questions*, rendering them less suitable for the workshop with child participants; the games chosen for the workshop were selected to be as different from each other as possible, each representing their own style, dynamic, and materiality. Such a decision was made in order to explore a larger variety of game anatomies and structures, so as to obtain a deeper insight into the preferences of the child participants.

Summary of Trends, Stage 2

The information discussed in stage 2 of the visual analysis is summarized below.

- Environmental preservation techniques and information about ecological threats and dangers dominate the content of the ten games. Flora and fauna trivia occurs less frequently, followed at last by information about natural resources.
- The most even distribution of environmental content was in *Bioviva* and *Eco Planet*, covering flora, fauna, natural resources, environmental threats and dangers, as well as preservation techniques.
- The average number of players intended for each game was six [a minimum of two and a maximum of ten]; the recommended number of players was four.
- There was an uneven distribution in the reward systems of the ten games, with two out of ten games offering the player game money and four games offering points; the rest of the games did not operate on a clear reward dynamic.
- Players were supposed to represent themselves and play without avatars in all ten games.
- The portrayal of the world / planet Earth was a balance between real, imaginary, and abstract imagery [photography, detailed illustration, simple illustration].
- The time periods and settings of each game were 50 percent abstract, 40 percent current, ten percent historical [past imaginary world; *Catan Scenarios*].
- The most frequently occurring game dynamic was race to the end, present in seven out of ten games [*Earthopoly*, *Bioviva*, *Eco Squad*, *Catan*, *Dirty Water*, *R-Eco*, *Terra*].
- The second most frequently occurring game dynamic was trivia [question-answer].

- There was a balance between luck and strategy among the ten games; game outcomes depended 50 percent on the decisions and moves of players and 50 percent on chance [probability].
- All games were fairly different and had very few similarities between them; card games had similarities to other card games due to the shapes and sizes of the playing cards; board games had little in common with other board games, aside from the presence of a game board.
- There were some rule similarities between games, *Catan Scenarios*, *Dirty Water*, and *20 Questions* shared most rule similarities with other games.
- The most unique games – visually, materially, and in content – were *Eco Squad* and *Bioviva*.

STAGE 3

For data visualization, please see Appendices, Visual Analysis, Matrix Diagrams, Stage 3.

Stage 3 of the visual analysis was structurally similar to the former stages, where the games were cross-referenced with each other and in relation to questions that were specifically created for each stage [see *Appendices, Visual Analysis, Matrix Diagrams, Stage 3*]. The questions were structured in a way that would facilitate the analysis of *Earthopoly*, *Bioviva*, *Eco Squad*, and *Eco Fluxx*, determining the similarities and differences between the games. As the general content and components of each tabletop game were already explored and discussed referencing matrix diagram 1 and matrix diagram 2, an even further analysis of each of the four games was carried out in matrix diagram 3, where *Bioviva*, *Eco Squad*, *Eco Fluxx*, and *Earthopoly* were analyzed for details of mechanics, content, and materiality, particularly the length and speed of play as well as the winning conditions. The main difference in the construction of matrix diagram 3 from the other two diagrams was the structure of the questions that were posed to each of the four games. The questions were purely verbal and qualitative in nature, a decision that was made in order to link the analysis of each following workshop to the visual analysis, so as to eventually create a homogenously flowing analysis of all collected data.

Consequently, the games *Earthopoly*, *Bioviva*, *EcoSquad*, and *Eco Fluxx* were carried over into third matrix diagram, which could be observed by referring to the diagrams in the appendices section of this document [see *Apendices, Visual Analysis, Matrix Diagrams, Stage 3*]. This stage of the visual analysis was created upon obtaining the four games into my physical possessions and spending time playing them, therefore a much more in depth understanding of the structure and components could occur. What follows below is a discussion of the trends projected by the third matrix, as well as my personal experience with *Earthopoly*, *Bioviva*, *EcoSquad*, and *Eco Fluxx*.

Materiality

All four games were made out of environmentally friendly materials, such as recycled fiber or paper; *Earthopoly* and *Bioviva* include character pawns as part of their game bits – all the character pawns were either made out of wood or are ‘found natural objects’, such as shells, beans, and stones. There were no characters in *Earthopoly*, *Bioviva*, *Eco Squad*, or *Eco Fluxx* – the players are intended to experience the games as themselves, as all

four games are built around the game mechanic of self-representation. This is an area of special interest for me and will be explored further, during the workshops and creation of the *Planet Play* prototype. Three out of four games did not offer the players a chance for drawing or writing on the game components. *Eco Squad* featured some blank cards in its deck, which were available to draw and write on, transforming them into additional *Eco Cards* that could be used in play. There was a balance of varying visual styles that were used in *Earthopoly*, *Bioviva*, *Eco Fluxx*, and *Eco Squad*. *Earthopoly* and *Eco Squad* contained a mix of illustration and photography, where the illustration was fairly abstract and simple, but the realism of the photographic representations created an attractive visual equilibrium. The visual style of *Earthopoly* appeared to be more visually appealing when compared to that of *Eco Squad*, mainly due to the higher saturation and brightness of the images in *Earthopoly* compared to those of *Eco Squad*, which were duller and darker. There was no use of photography in *Bioviva* or *Eco Fluxx*, yet the animals and plants, which were depicted in both games were beautifully illustrated, to a degree of realism that would seem appealing to fourth grade children. The colors used for illustrating the animals and plants depicted in *Bioviva* were quite basic and could be summarized as a combination of primary, secondary, and tertiary, with some degree of saturation variance towards browns and grays; the same color trends were observed in *Eco Fluxx*. *Earthopoly* and *Eco Squad* utilized a visual combination of photography and illustration, therefore – mainly due to the presence of photographs – the colors in both games were much more diverse and plentiful, than in *Bioviva* and *Eco Fluxx*.

Content

There was a balance of environmental trivia presence in the structure of the games and their rules. *Bioviva* and *Eco Squad* operated purely by using the trivia containing questions and answers; *Earthopoly* and *Eco Fluxx* had underlying subtle trivia, which did not directly affect the structure or dynamics of the game play, yet if noticed, could become useful to the player. From my personal observations – prior to the workshops and after examining my chosen 30 environmental games in detail in stage 1 [matrix 1] – it appeared that *Earthopoly*, *Bioviva*, *Eco Fluxx*, and *Eco Squad* all contained environmental trivia that was suitably educational yet not overly complex, complying with the content found in the Alberta Elementary School Science Curriculum. Furthermore, *Earthopoly*, *Bioviva*, *Eco Fluxx*, and *Eco Squad* were initially selected from the rest of the tabletop games, specifically due to the accessibility of their content and mechanics for the age group of participants for whom the games were intended. Games like *Catan Scenarios* or *Terra* would certainly be too complex for fourth grade students, primarily because of their advanced structure [which would require much longer than 30 minutes to explain, understand, and experience, in order to obtain some sort of feedback from the process].

Similarly to other trends observed in matrix 3, there was a balance of the educational versus entertaining values of the trivia present between *Earthopoly*, *Bioviva*, *Eco Fluxx*, and *Eco Squad*. The games were chosen intentionally for this reason, as two were board games and two were card games; this appealed to my interest, to observe participants' experiences with less educational, yet more entertaining board game [*Earthopoly*] and card game [*Eco Fluxx*], versus less entertaining and more educational ones [*Bioviva*, *Eco Squad*]. Naturally, this observation was sought out for the creation of my own prototype, for which I wished to find my own balance between entertainment and educational value, as previously discussed in the literature review. The type of trivia, which was used in each of the four games, did not appear to be an attention distracting factor, however I realized my role as not being that of the target audience of *Planet Play*, and therefore posed this question once more in the data analysis stage after

the first workshop took place. As participants played *Earthopoly*, *Bioviva*, *Eco Fluxx*, and *Eco Squad*, their opinions were recorded regarding the distraction factor of the trivia in each of the four games. [Further on this in the analysis of workshop one.]

Only *Eco Fluxx* did not appear to contain practical environmental suggestions, the other three games – particularly *Bioviva* and *Eco Squad* – offered marvelous trivia as well as advice regarding environmental preservation techniques. *Eco Fluxx* contained potentially interesting information about flora and fauna and operated on the mechanic of speed and matching – which would teach players to be attentive and follow instructions – all techniques that could surely benefit the player; this was one of the reasons for selecting *Eco Fluxx* to be among the games introduced to child participants. The highest level of environmental content diversity was observed in *Bioviva*, a game that covered flora, fauna, natural resources, threats & dangers, as well as preservation techniques. *Eco Squad* came in second, providing a wide range of environmental preservation techniques, however much less focus on the other four areas composing the content of environmental educational games. *Earthopoly* and *Eco Fluxx* displayed a strong focus on natural resources and fauna respectively, lacking or merely mentioning trivia related to preservation techniques, flora, or environmental threat and dangers. Combined together, however, all four games would be a valuable source of diverse environmental content for the child participants, who were going to experience the games during the first workshop.

The portrayal of planet Earth, as well as its more localized regions, was one of the most important aspects to explore for the creation of the *Planet Play* prototype, since the name ‘*Planet Play*’ implies a depiction of the planet in some form or another in / on / among the game bits; therefore, analyzing *Earthopoly*, *Bioviva*, *Eco Fluxx*, and *Eco Squad* for their own versions of representing the planet was crucial for my prototype. Given that *Earthopoly* had an identical visual structure to *Monopoly*, its portrayal of planet Earth was abstract – the planet Earth itself was not shown directly, but implied through an encircling arrangement of invented natural habitats and imaginary regions – such as *wondrous waterfalls*, *deserted deserts*, or *watery wetlands*, to name a few. *Eco Fluxx* and *Eco Squad* were both card games, therefore did not include a board as one of their game bits; the representation of the world / planet Earth was absent altogether in *Eco Fluxx*, a game that specifically focused on flora and some fauna, as opposed to a more general outlook on Earth. *Eco Squad* operated with real-life contemporary content, therefore its depiction of the planet Earth was concrete and realistic, albeit conceptual, not directly-representational visually. For instance, photographs depicting lawn mowers, sprinklers, or garbage cans could be associatively linked to Earth, creating a localized feel for the players. Finally, *Bioviva*’s game board was designed as a map of the world, segmented into different continents with occasional examples of individual animals that inhabit the regions. *Bioviva*’s representation of the planet Earth was therefore the closest out of the four games to being ‘concrete and real’, since it both showcased the planet as a whole and also offered players the chance to move around the board in a manner that resembles traveling the different climates and continents of our globe.

Mechanics

Prior to acquiring *Earthopoly*, *Bioviva*, *Eco Fluxx*, and *Eco Squad* into my physical possession, the initial examination of their rules was performed digitally, through various Internet resources that offered information about the games. The descriptions and depictions of the game rules online, presented all four games to appear adequately simple and accessible to be introduced to child participants. Upon the physical acquisition and attempts at playing *Earthopoly*, *Bioviva*, *Eco Fluxx*, and *Eco Squad*, a detailed

further examination of the rules made it evident to me that while *Bioviva* and *Eco Squad* were designed with straightforward and comprehensible mechanics that could be explained to research facilitators and child participants relatively promptly, doing the same with *Earthopoly* and *Eco Fluxx* could be potentially troublesome. The rules to *Earthopoly* mimicked those of *Monopoly*, therefore explaining or understanding the game would completely depend on the familiarity of facilitators and child participants with the original mechanics of *Monopoly*; if the mechanics were known, then *Earthopoly* would pose absolutely no challenge, however, those unaware of game concepts revolving around bidding, trading, buying, and mortgaging, would need detailed clarification about *Earthopoly*'s structure. Furthermore, the mechanics to *Eco Fluxx* were complex beyond the rest of the four games, operating similarly to only those of *R-Eco* – a game that also involved mechanics of race to the end and strategic matching of similar cards [refer to stage 2 of the visual analysis]. Understanding the rules to *Eco Fluxx* fluently enough to be able to not only play it myself, but also fashion a simple enough explanation of the mechanics to the research facilitators [who would in turn explain the game to the child participants] required a time commitment significantly longer than the time allocated to the workshop where the games would be played by the child participants.

The entertainment / engagement factor seemed strongly present in *Earthopoly*, *Bioviva*, and *Eco Fluxx*, all colorful, mostly fast-paced games, with interesting environmental trivia to compensate for a sometimes slower pace. *Eco Squad* was not as alluring visually and its mechanics brought into view a slower, more monotonous game dynamic; however, the amount and depth of content in *Eco Squad*, as well as its parallel to the content of the Alberta Elementary School Science Curriculum, balanced out the game's lower entertainment / engagement factor, making it an obvious choice for the child participants to experience. The speed / pace of the games was categorized as fast for *Earthopoly* and *Eco Fluxx*, both of which functioned around a mechanic of less trivia and more action; the play speed was determined as slow for *Bioviva* and *Eco Squad*, as each game contained a large amount of trivia, the reading, comprehension, and retention of which slowed the pace of play down. Therefore, selecting *Earthopoly*, *Bioviva*, *Eco Fluxx*, and *Eco Squad* for the first workshop ensured that participants would have a chance to experience a board and a card game that were both fast-paced, as well as a board and a card game, which were both slow paced; thus, facilitating my understanding of the pros and cons of each design approach, so as to later apply the information to creating the *Planet Play* prototype.

Bioviva had a motivating mechanic of play, where all players collective progress along the board on each turn; everyone playing the game rolls the dice and moves the required amount of steps along the *Bioviva* game board, upon which, the player whose actual turn it is to answer the trivia question – does so, collecting Eco points for a correct answer and nothing for an incorrect one. The joint advancement of players guarantees their attention to be engaged throughout the course of the game, whereas the one-at-a-time progression of play that was present in the three other games, might have appeared somewhat lackluster for children involved in the game [as it would require them to patiently wait for the player with the current turn to finish].

The concept of money was not at all present or even mentioned in *Bioviva* or *Eco Squad* – the reward system of each game was in the form of collectable game bits, which were *Eco Points* [*Bioviva*] and *Goal Cards* [*Eco Squad*]. Furthermore, the game mechanic of *Eco Fluxx* was structured around reaching a set goal, as described on the *Goal / Action Cards*, which players would match with their animal / plant cards [*Keeper Cards*]; therefore, no monetary or mercantile aspect existed in *Eco Fluxx* either. *Earthopoly*, on

the other hand, not only mentioned and used play money [like *Monopoly*, where play money has many visual recognizable similarities to dollar bills], but the game's entire dynamic was based on buying, trading, and mortgaging – all very mercantile concepts, which in my view would be unconstructive as well as complex for the development and comprehension of young children. Nevertheless, *Earthopoly* was selected to be one of the four workshop games, in large for the reason of its use and representation of money, which was an area of game bits development that I was interested in exploring with child participants, in order to potentially try a similar approach in *Planet Play*.

Given that *Earthopoly* and *Bioviva* were both board games, their full completion with an emerging winner could potentially last up to two hours; this was a commonality among most board games in general – regardless of their theme – and particularly with all board games examined by me in the first and second stages of the visual analysis. Therefore, *Earthopoly* and *Bioviva* were expected to be not fully completed during the workshop with child participants, as only 30 minutes were allocated to the process of playing each game. *Eco Fluxx* and *Eco Squad* were both card games, therefore the possibility of them each being completed with a winner emerging at least once throughout the workshop was high; predominantly this was the case with *Eco Fluxx*, which due to its fast-paced game mechanic could without difficulty be completed within 10-15 minutes.

Summary of Trends, Stage 3

The information discussed in stage 3 of the visual analysis is summarized below as follows:

- Four environmental board games were analyzed; their materiality, content, and mechanics were examined inside a matrix containing questions.
- All four games were made out of environmentally friendly materials, such as recycled fiber or paper.
- There were no characters or avatars in any of the four games, therefore the players represented themselves during play.
- There was a balance of varying visual styles in all four games, including photography and illustration.
- The games represented a balance of environmental trivia in their structure, consisting of flora, fauna, natural resources, environmental threats and dangers, as well as preservation techniques.
- There was a variety of education and entertainment values in *Earthopoly*, *Bioviva*, *Eco Fluxx*, and *Eco Squad*; *Eco Squad* was the most educational, *Eco Fluxx* was the most entertaining.
- Combined together all four games could offer the players a diversity of environmental content, as well as environmental tips and advice.
- Not all games depicted the planet Earth among their game bits; *Bioviva* had the most realistic portrayal of the planet, and *Eco Fluxx* the most abstract portrayal.
- The rules to *Earthopoly* were identical to those of *Monopoly*; *Bioviva* was similar to *Trivia Pursuit*; *Eco Fluxx* could be compared with *R-Eco* or even *Uno*; *Eco Squad* displayed some similarities with *20 Questions*, however was overall more akin to flash cards or any other academic study aids.

- No presence of a monetary or a mercantile aspect existed in *Bioviva*, *Eco Fluxx*, *Eco Squad*; the game dynamic of *Earthopoly* was based on buying, trading, and mortgaging, all involving play eco money.

The above statements, analyses, and trends were determined by the literature concerning user-centered and game design, as well as child psychology and development; however the actual experience of the behavior of child participants in regard to these assumptions was often unexpected. The data analysis of each workshop explores these subjects further.

WORKSHOP 1

The materials for the first workshop were based on the combination of information derived from the literature and the visual analysis, specifically the trends projected by *Earthopoly*, *Bioviva*, *Eco Fluxx*, and *Eco Squad*. The materials used during the workshop consisted of question cards, mind maps, games, and feedback sheets. Only four games were selected for the first workshop, a decision that was made in order to accommodate an average sized classroom, which could not be dividable – in a way that would allow a large number of games to be played – while simultaneously being observed. Furthermore, considering that both workshops would take place during regularly scheduled class time and the amount of time allocated for conducting them was limited, fitting in a play session that included all ten tabletop games would have been impossible.

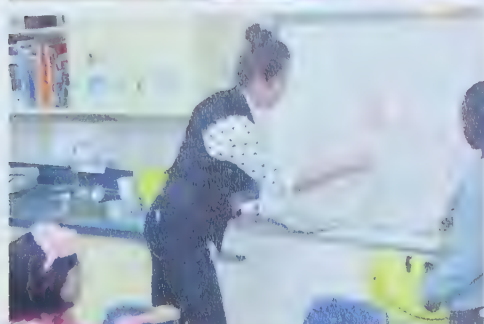
The workshop consisted of 30 participants and four research facilitators. Participants were separated into four groups, one group per facilitator and asked to take part in answering questions from question cards, followed by a brainstorming session, where their answers would be recorded onto graphic organizers [mind maps]. The mind mapping was followed by playing *Earthopoly*, *Bioviva*, *Eco Fluxx*, and *Eco Squad*, and concluded with a feedback session between facilitators and their groups. Prior to commencing the question card and mind map sections of the workshop, a quick demonstration was made by the research facilitators and me, where we presented to participants each activity that was ahead of them.

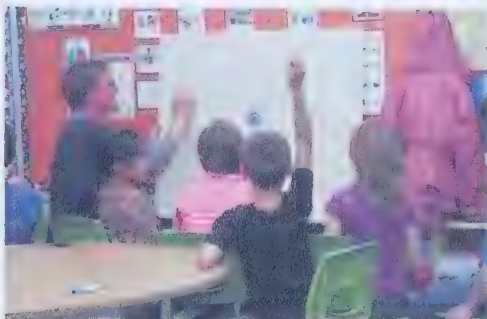
Question Cards

During the question card portion of the workshop, participants answered environmentally themed questions in written and / or illustrative format [whichever the participants felt suited them best]. There were a total of 30 questions formulated for this section of the workshop, and the structure and content of the questions were derived from the Alberta Elementary School Science Curriculum, ensuring that the participants were [somewhat] familiar with the information. The questions were separated into five themes: 1. general knowledge / 2. dangers and concerns / 3. recycling and waste management / 4. water, energy, natural resources / 5. plants and animals. The themes were color-coded and a symbol was designed to represent each of the five categories. The questions were printed on recycled brown paper and cut into 17x17cm [6.7x6.7 in.] cards; the color pertaining to each card's theme formed a frame around the question and its symbol. The back of the question cards was left blank for participants to record their answers on. Each question repeated at least once, therefore, 70 question cards were distributed among 30 participants. The cards were shuffled and handed out to participants by the workshop facilitators. All cards were given out at random and later collected and examined as group results. Over the total time period of 20 minutes, each participant answered approximately two / three questions independently, as well as contributed to the answers of their peers, if they so desired.

Mind Maps

Four large mind map boards measuring 50x76cm [20x30 in.] were created prior to the workshop; the mind map boards were empty of content, except for symbols indicating *dangers and concerns*, *recycling and waste management*, *water, energy, natural resources*, and *plants and animals*. Questions from the first part of the workshop were reworded to form a set of 28 new questions, which were also derived from the Alberta Elementary School Science Curriculum. The similarity between questions from the first and second parts of the workshop was intentional – in order to understand the type and depth of environmental content that the participants were familiar with, the same questions were asked in a slightly differently worded format, thus allowing participants the possibility to see the content from a





different perspective. Mind map boards were assigned to the four research facilitators, who were instructed to ask participants in their group questions from the question sheet, specifically focusing on the topic of their mind maps. For instance, if a research facilitator and their group were assigned to brainstorm about the topic of *recycling and waste management*, then the questions that facilitator would ask, would be environmentally themed, with an inclination towards recycling and waste management, rather than *plants and animals, threats and dangers*, or *water, energy, and natural resources*. For a full list of questions and their sub-categories, [see *Appendices, Ethics Application, Documentation, Workshop 1, Mind Map Questions*]. Over the total time period of 20 minutes, participants would offer their answers to the questions posed by facilitators, who recorded the answers onto the mind maps.

Games and Feedback

After recess, participants returned to the classroom, where we resumed the workshop by playing *Earthopoly*, *Bioviva*, *Eco Fluxx*, and *Eco Squad*. 30 participants formed two groups of six – for *Eco Fluxx* and *Eco Squad* – and two groups of nine – for *Earthopoly* and *Bioviva*. The large number of participants did not match the requirements of each game's player limit – 6 players maximum for each game, therefore, the progression of play in *Earthopoly* and *Bioviva* was arranged such, that participants would be partially in teams and partially play independently, so as to include all students of the fourth grade class in the process. Facilitators were briefed prior to commencing the workshops, therefore they were familiar with the rules of their games, which they explained to participants as the games commenced; no prior explanations were given, which was a decision that was made in order to maximize the time of playing each game, as well as to facilitate the flow of understanding the rules, since practical demonstrations take less time and are more effective than verbal ones. Over the total time period of 30 minutes, participants played the game that was assigned to their groups; the comments and reactions of participants to the four games, were all observed by the research facilitators, who recorded their observations on feedback sheets, which were filled out by them after the workshop ended.

Upon finalizing the game-playing portion of the workshop, research facilitators asked their groups for feedback about their experiences, preferences, and suggestions regarding the games they just finished playing. Each facilitator was provided with a question sheet, consisting of 17 questions, which can all be found in the *Appendices, Ethics Application, Documentation, Game Feedback Questions*.

The data collected from the workshop with question cards and mind maps, as well as my own observations in conjunction with the reflections of facilitators and the feedback from participants, is discussed below.

ANALYSIS OF WORKSHOP 1

Similarly to the way existing environmental games were examined within a visual analysis prior to the workshop, the data from question cards, mind maps, and observations, which was collected during the workshop was transcribed as key words and answers [see *Appendices, Question Card Transcriptions*] and then placed into a matrix. The matrix consisted of questions, formulated in a manner that would facilitate the organization of data into categories – materiality, content, mechanics – so as to comprehend which aspects of the workshop sessions were appealing and memorable to participants.

For data visualization, please see Appendices, Visual Analysis, Matrix Diagrams, Workshop 1.

QUESTION CARDS & MIND MAPS

Out of 70 question cards, all were filled out and collected from the participants at the end of the workshop. 57 cards were answered with both pictures and text, 14 were answered with pictures only, 12 were answered with text only. During the first two sections of the workshop, participants expressed considerable excitement about the bright colors of the question cards, and some participants even went on to decorate the solid colored areas with images unrelated to the content of the cards. The colors of the mind map branches were commented on numerous times by different participants; some comments were related to the content [e.g. “It’s blue because it’s about water!”] and some were completely random [e.g. “Look, my socks are the same color!”]. No color in particular was isolated with comments regarding preference, however the color red of the *threats and dangers* category was noted by some participants, suggesting that “it’s explosions!” that the color represents. The four symbols used in the question cards and mind maps were much appreciated by participants, some children even expressed a desire to take the symbols home “to put on my wall”. The symbols for *recycling* and *threats & dangers* were preferred and requested the most by the participants.

As mentioned previously, the content in the question cards and mind maps consisted of a combination of material taken from the Alberta Elementary School Science curriculum and the information selected from *Earthopoly*, *Bioviva*, *Eco Fluxx* and *Eco Squad* during the visual analysis. Therefore, the complexity of the question cards and the mind map brainstorming materials was aimed to be consistent with the complexity of information participants have already learned prior to entering grade four; as well as information they would learn during their fourth year of school. The responses of participants to question cards and mind maps were mostly consistent in demonstrating awareness of basic environmental issues, however some of the terms and content were unknown to participants – mainly the subjects of fossil fuels and global warming. Questions revolving around recycling, garbage disposal and food chains were most appreciated and commented on; participants also enjoyed illustrating images of landfills. Moreover, participants answered the question cards and the mind maps with a mix of illustrative and written responses; an overall examination of the workshop materials indicates a preference for pictorial representations of concepts, rather than written ones.

The question card responses signified that general knowledge and awareness about environmental concepts was present among participants. There also appears to be an understanding of cause-effect relationships that occur in the environment, such as inefficient use of energy or ecologically unfriendly modes of transportation leading to problems like pollution, deforestation, and extinction of animals. The difference between materiality of garbage was clearly understood, as well as the circumstances of improper disposal.





Animals were frequently referenced and depicted, occasionally as answers to non-animal related questions. The answer side of the cards [which was used by participants] often mimicked the question side – participants appeared to be utilizing the same visual approach as the question cards, where important words are emphasized in a different color.

Numerous answer sides of question cards demonstrated a strong connection between environmental information presented to the participants in my opening speech [see *Appendices, Ethics Application, Documentation, Protocol 1/*] and the answers given by participants to the questions they were asked; therefore, it can be presumed that whatever information is introduced by a teaching tool – such as a game – could transform into information that is immediately understood, remembered, and referenced by participants. Finally, there was a commonality among the answers of participants who were sitting around each other – some written content and illustrations are conceptually similar – indicating teamwork among participants and their desire for moving towards a shared goal.

Participants were most knowledgeable about content related to recycling and waste management, which – as confirmed by their teacher – was because the group had just recently covered the subject over the course of the few weeks leading up to the workshop. Nevertheless, participants expressed particular interest in the flora and fauna aspect of the content, which appeared to engage their interest more than the other subject areas. Participants referenced their families and the environmentally friendly practices of their home life, which were occasionally illustrated on the question cards. The question cards were more personalized than the mind maps [which were done as a group activity], therefore the amount of illustrative content was initially much lower on the mind maps [as they were filled out by the research facilitators, mainly with words]. However, in the last five minutes of the mind map session, participants were asked if they wanted to draw on the mind maps, a suggestion that was met with lots of enthusiasm from them. Therefore, the illustrative content of the mind maps is as dense – if not denser – as the illustrative content of the question cards, however the visuals are less related to the environmental questions, which the facilitators were asking participants prior to giving them the opportunity to draw on the mind maps. Participants created a number of imaginary creatures and on both the question cards and especially the mind maps; the creatures were mostly unrelated to the content, however some participants mentioned that it would be a good idea to add the creatures into the games, a suggestion made during the playing of *Earthopoly*, *Bioviva*, *Eco Fluxx*, and *Eco Squad*.

Overall, the participants' commentary on the color choices and the symbols of the question cards and mind maps was a useful contribution to the color choices of the *Planet Play* prototype, which incorporated all of the symbols and colors from the question cards and much of the content [wording] of both the question cards and the mind maps. Full transcriptions of the question cards and photographs of the mind maps can be found in the Appendices section of this document.

OBSERVATION AND FEEDBACK: *EARTHOPOLY*, *BIOVIVA*, *ECO FLUXX*, *ECO SQUAD*

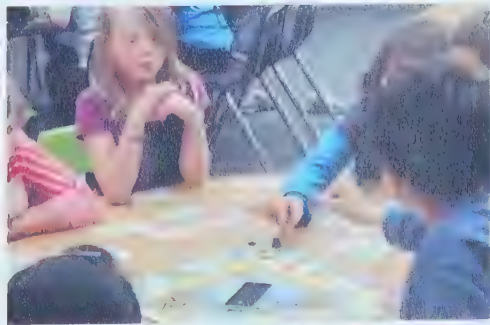
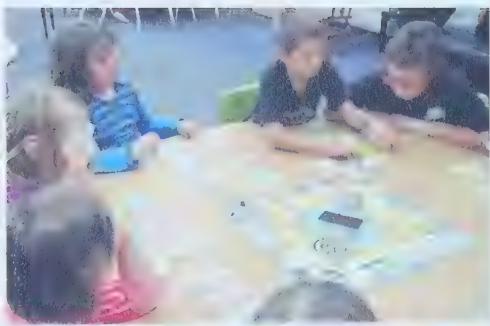
Materiality

Overall, the colors used in *Earthopoly*, *Bioviva*, and *Eco Fluxx* were enjoyed by participants, who made positive comments about them independently during the process of the workshop, as well as confirming their opinions formally during the feedback session at the end of the workshop. *Eco Squad* was commented on by some participants as being “too dark and blue”, requiring more animals, illustrations and bright colors, however this was not a unanimous attitude, as other participants reacted to the colors of the game with enthusiasm during the feedback session.

Participants thoroughly enjoyed *Earthopoly*, possibly because they were familiar with *Monopoly* and saw many recognizable similarities that made them comfortable with the game. *Earthopoly* was also the most visually diverse game out of the four that were tested during the workshop, as it combined illustration with photography and made use of the brightest color palette – all factors that resonated well with the group of participants playing it. Furthermore, the inclusion of money into the material components of *Earthopoly* certainly engaged the attention of the participants, who were continuously counting their bills and comparing their success to that of their teammates. The materiality of *Bioviva* was mainly questioned in regard to its size – participants thought the game board to be too small and made numerous suggestions for an increase in size; one participant stated that the size of *Bioviva*’s board should be “so big that I can stand and walk on it”. This is an understandable request, seeing that the design of the game’s board is much like a map of the world separated into five continents, and the play mechanics presume traveling across the world as the character pawn; hence, the participant whose suggestion was to make the board extra large, seemed to have reacted to the key concept of the game’s mechanics, wishing to take it a step further by physically interacting with the board. The opinions of participants in regard to the materiality of *Eco Fluxx* and *Eco Squad* – which were composed of cards as the only components in both games – were positively neutral; participants were mainly content with the saturation and brightness of colors in each game, yet expressed concern regarding the lack of customizable characters or photographs of animals.

The character pawns used in both *Earthopoly* and *Bioviva* were very neutral and might have therefore been perceived as impersonal; *Earthopoly*’s *objet trouvé* character pawns consisted of two shells, a bean, a rock, a piece of wood, and a cross section of a bamboo – all natural organic objects, however still lacking personification. The same can be noted about *Bioviva*, containing beautifully crafted wooden character pawns in the shape of water droplets, also consistently organic and made with vegetable ink, yet tricky for relating to on a personal level, as an animal or even plant [something with a face] could be. Child participants involved in both games have expressed a strong desire to draw on / decorate the character pawns of *Earthopoly* and *Bioviva*, as well as give them names or assign abilities. Similar requests were made in regard to *Eco Fluxx* and *Eco Squad*, as participants inquired about whether or not they were allowed to draw on the game cards; when asked what their intended drawings would consist of, participants responded with propositions of depicting animals, themselves, or their friends.

Earthopoly, *Eco Fluxx* and *Eco Squad* are all games dense with imagery – both illustrated and photographic; therefore, participants primarily seemed to enjoy examining the imagery, rather than focusing on the content of the questions or scenarios of the games. The mechanics of *Bioviva*, on the other hand, do not rely on imagery for the game to function [unlike *Eco Fluxx* and *Eco Squad*]; therefore, aside from a few illustrated animals on the *Bioviva*



game board, the game contained no imagery, which participants expressed mild discontent towards and showed an interest in adding imagery of animals. The primary focus of *Eco Fluxx* is flora and fauna, therefore participants enjoyed the multitude of illustrations throughout the process of playing the game, and did not suggest improvements or changes to the visual content. *Earthopoly* engaged participants to a high degree, where their main concern was directed towards earning eco dollars and not changing or improving the imagery used in the design of the game. Participants were most interested in using the provided crayons and markers to draw anything ranging from illustrations of the game's content to unrelated, yet personally significant imagery.

The main words that were used for summarizing the four games were “terrific” and “awesome” – they repeated the most out of all the other descriptors. *Bioviva* was labeled as “challenging” and “boring”, however those adjectives were balanced out by “amazing” and “awesome”. *Eco Fluxx* was described as ‘beautiful’ and ‘active’ and *Eco Squad* as “terrific and awesome”, as well as “fun” for both games. *Earthopoly* was given the highest number of superlative descriptors out of all the other games – “outstanding” being one of them.

Content

Earthopoly's structure is such, that the game is played without having to read or answer environmental questions; an understanding of environmental trivia is also not a necessity, since the game operates on a roll and move mechanic, which is all that players really require to keep to, in order to participate in the process. *Earthopoly* does, however feature very diverse and interesting combination of environmental facts and figures, as well as useful tips – all of which are located on the backs of property cards that are bought by players upon landing on the properties. The environmental trivia offered in *Earthopoly* was not at all noticed by participants, due to their enthusiasm to keep rolling and moving around the board, which created a general lack of interest directed towards listening to the facilitator reading the back of the property cards out loud. Therefore, since listening to or reading the environmental trivia featured in *Earthopoly* was not part of the game's dynamic, then it can be stated that participants did not find the trivia too complex. The same cannot be said with regard to *Bioviva*, the complexity of which was somewhat more advanced, as well as the diversity of its trivia. Operating on a question / answer dynamic, the rules of *Bioviva* required participants to focus on the content of the question cards, listening to the question and to the multiple choice of potential answers; this was not always achievable during the workshop, as participants became distracted by the length of the questions, as well as by the lack of visual or tactile stimulation the game seemed to provide them with. Furthermore, to account for the large number of students attending the workshops, *Earthopoly* and *Bioviva* were played in small teams of 2, as opposed to individually [as it was with the card games]. Playing with partners did not disturb the dynamic of *Earthopoly*, as both players would only be required to make one important decision – choose which one of them rolls the dice; *Bioviva*, on the other hand, was not always played as smoothly – two people would be requested to answer the same question, which occasionally created a state of verbal discord and negotiations, slowing the entire process of play down. Additionally, some content of the *Bioviva* question cards revolved around reproduction trivia and sexual terminology [such as: “which animal changes sex as it gets older? The shrimp / the mole / the snake. Apparently, the shrimp, as it “is a hermaphroditic animal, since it can be both male and female”]; these types of questions were skipped by the game facilitator, considering the teacher's counsel, advising me that the group will not be instructed about these matters or terminology until their middle school years. It can overall be supposed that the trivia and content of *Bioviva*'s question cards

were not entirely complex when they concerned environmental issues and terminology that participants have been familiarized with in science class, yet other types of trivia, as well as the conditions under which the content was presented to the participants made *Bioviva*'s complexity level the highest compared to *Earthopoly*, *Eco Fluxx*, and *Eco Squad*. Participants seemed very comfortable with the content contained in the questions and cards of both *Eco Fluxx* and *Eco Squad*; throughout playing the game, participants did not have trouble with understanding what the cards required of them.

Whether participants found the trivia of each game memorable, was determined based on their verbal feedback about the games, as well as on the comments they made to each other upon completing the games; if participants made comments that were related to the content of the game, then the game could be perceived as memorable. Participants did not comment on the environmental content of *Earthopoly* or *Eco Fluxx*, merely on the great experience they had playing both games, as well as their appreciation of the game components. Participants did not demonstrate any preference for a specific theme from the list of flora / fauna / natural resources / environmental dangers or solutions, therefore the content and trivia of *Earthopoly* and *Eco Fluxx* can be evaluated as not memorable.

The question cards from *Bioviva* were mentioned a number of times – the themes of animal sizes, lake depths and mountain heights were referenced, where participants communicated parts of the information contained in the question cards to each other in conversations that took place after class ended [some participants even shared the trivia with their parents, who arrived to pick them up from class]. Furthermore, recycling tips as well as facts and figures related to the decay duration of plastic were both a source of much discussion among participants; this trivia was offered by the game cards of *Eco Squad*, and mentioned one more time during the second workshop, which took place three weeks after the first one. Therefore, both *Bioviva* and *Eco Squad* contained trivia that was memorable, with participants demonstrating an inclination of preference towards flora and fauna themes in *Bioviva*, and environmental dangers and preservation techniques in *Eco Squad*.

There were no negative comments about any of the game worlds – *Eco Fluxx* was the only game to the world / theme of which one participant responded negatively at first, stating that it is “not realistic” explaining her opinion as “there are no people in the game”; *Eco Fluxx* does indeed only focus on animal and plant [and not human] interactions within ecosystems, which was explained to the participant, upon which she claimed to have changed her mind, stating that she “like[s] the game now”. Overall, participants were unanimous in their positive attitude towards the game world, visual theme, and story of all four games.

Mechanics

The rules of each game were explained to participants as the games commenced – no prior explanations were given, which was a decision that was made in order to maximize the time of playing each game, as well as to facilitate the flow of understanding the rules, since practical demonstrations take less time and are more effective than verbal explanations. Following the rules of *Earthopoly* was not difficult for participants, because they were already familiar with *Monopoly*, however *Bioviva* and *Eco Fluxx* posed somewhat of a complication for facilitators to explain to their groups – a process that lasted approximately ten minutes. *Bioviva*'s rules are straightforward and clear to follow, therefore the only delay related to the game was with organizing the participants into a somewhat composed and cooperative state, where they could stay on track with the rules of the game along with their partners. *Eco Fluxx* has the most confusing rules, where the game required to be simplified prior to the workshop – certain

cards were removed, which did not change the core mechanic or dynamic of the game, but made for a less complicated explanation process. Even though the explanation of the rules of *Eco Fluxx* was slower than expected, it was a pleasant surprise to watch participants actively helping each other to determine their playing options and rights. Out of the four games, *Eco Squad* was the game with the most basic rules, and was predictably simple to explain to participants without confusion or delays.

All four games are paced differently – being board games, *Earthopoly* and *Bioviva* were slower than *Eco Squad* and *Eco Fluxx*; additionally the speed of play varied within the board / card categories, where *Bioviva* was much slower to play than *Earthopoly*, and *Eco Squad* was a slower game when compared to *Eco Fluxx* [due to the amount of trivia and overall participant engagement]. Nevertheless, in their post-game feedback, participants unanimously agreed that each of the games was comfortably paced and confirmed that they would not change the speed to be faster or slower.

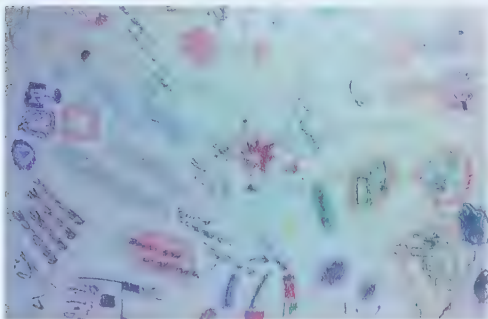
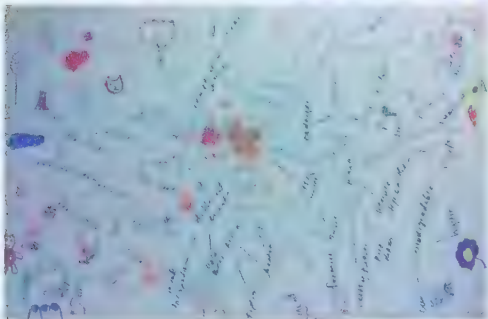
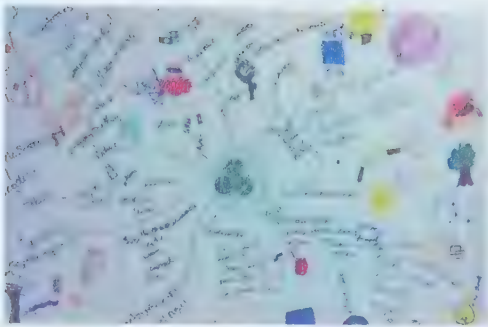
The large number of participants did not match the requirements of each game's player limit – 6 players maximum for each game, therefore, the progression of play in *Earthopoly* and *Bioviva* was arranged such, that participants would be partially in teams and partially play independently, so as to include all students of the fourth grade class in the process. *Eco Fluxx* and *Eco Squad* were played independently and participants were not arranged into small teams, therefore their experience with the games was more individualistic. Out of 30 students, six played *Eco Fluxx* and six *Eco Squad*, with the remaining 18 students divided between *Earthopoly* and *Bioviva* – nine players for each game, where three would play independently and six participants were arranged into three groups of two. Overall, playing *Earthopoly* was enjoyed by participants both independently as well as in small teams of two; *Bioviva* was preferred by participants who played it independently, mainly because the independent players gave their answers to trivia questions quicker when compared to players in small teams, who required to consult and discuss the answer with their teammate. Even though *Eco Fluxx* was played independently, the participants demonstrated a very interesting inclination towards assisting the choices and move decisions of their game-mates, offering each other help and advice. This leads me to presume that *Eco Fluxx* could potentially work well as a team game as well as being a single player game. Finally, participants playing *Eco Squad* independently said to have enjoyed the game, moreover, no surprising or unusual dynamic was observed throughout the process.

Earthopoly was the only game that was not fully completed in the 30-minute time period that was allocated to playing it, however that was to be expected, seeing that the recommended play time for *Earthopoly* to be fully brought to an end is 120 minutes. The other three games were completed, with winners emerging in each team. Winning the game generated positive enthusiastic reactions from all the winners and a range of emotions from neutrality to disappointment from the rest of the players. Participants expressed a desire to continue playing *Earthopoly*, *Bioviva*, *Eco Fluxx* and *Eco Squad* after the time allocated for playing the games was up; moreover, when questioned whether participants would play *Earthopoly*, *Bioviva*, *Eco Fluxx*, or *Eco Squad* in their free time, the answer was an enthusiastic, harmonious “yes!”. Furthermore, most participants were so taken with their game, that they inquired multiple times where and how they could purchase it in order to “play at home all the time” or “instead of doing class exercises”.

Summary of Workshop 1

In order to apply the information gathered during this workshop to the design of the board game *Planet Play*, the following were evaluated / analyzed:

- The content of the question cards, including adjusting the levels of its complexity based on the responses of participants and on the connection of the content to the Alberta Elementary School Science Curriculum [information that was not known or understood by participants, yet was included in the curriculum would stay in the game, however would be re-worded, so as to be a liaison to the curriculum, cooperating with the official content in a familiar manner, rather than quoting directly from it];
- The color and form of the symbol for each of the five themes [the symbols were very popular during the workshop, therefore, they were included in the design process, thus capitalizing on graphic elements that were pre-approved and did not require to be re-introduced as something unfamiliar during the next workshop];
- The most preferred features of *Earthopoly*, *Bioviva*, *Eco Fluxx*, and *Eco Squad* [participants expressed strong opinions and provided feedback about each of the four games during the workshop. The positive aspects of the games were referenced and enhanced in *Planet Play*, whereas the negative aspects were avoided as much as possible during the design process];
- The materiality, content, and mechanics of *Earthopoly*, *Bioviva*, *Eco Fluxx*, and *Eco Squad*, in combination with referencing the literature on game development.



PROTOTYPE DESIGN

Derived from the data analysis of the first workshop, the visual analysis of existing games, and the literature, a prototype for the game *Planet Play* was created. Similarly to the visual analysis of existing games and the data analysis from the first workshop – which both examined games and procedures based on their materiality, content, and mechanics – the materiality, content, and mechanics of *Planet Play* were composed around theoretical and practical notions of game development.

The design of the prototype's materiality, content, and mechanics was approached in a gradual building up manner, beginning with the theory and concepts derived from the literature for its base, adding the trends projected by the visual analysis of existing games, and concluding with the data collected and analyzed from the first workshop with participants.

LITERATURE REVIEW

The prototype combined information about game development basics and theoretical advice on the anatomy and mechanics of games, which were taken from *Rules of play* (Salen & Zimmerman, 2004) and *Challenges for game designers* (Brathwaite, 2009). Furthermore, being an educational and informative tool, *Planet Play* pertained to the category of information design, therefore *The visual display of quantitative information* (Tufte, 1983) and *Communication design: Principles, methods, and practice* (Frascara, 2004) were all theoretical bases for the visual style of the game prototype. Notions of *flow*, *ludic activity*, as well as *scaffolding* and user-centered design and experience were considered and applied to the game where possible. The rubrics created by Caillois regarding essentials of game design and Sutton-Smith and Vygotsky's research regarding play and development were also integrated into the base of the *Planet Play* prototype. The key concepts taken from the literature and applied to the design [materiality, content, mechanics] of *Planet Play*, were as follows:

1. Materiality of Planet Play

Consistency and repetition of images: Using informative images / symbols consistently, so as to create a flow of similarities, thus facilitating the brain's ability to solve problems and answer questions more efficiently. "Mobilize every graphical element, perhaps several times over, to show the data" (Tufte, 1983, p. 139), because "designers tie every feature in the game back into that single core mechanic in some way that ultimately makes the game stronger." (Brathwaite, 2009, p. 6)

The color red for attracting attention: Using the color sparingly, only for situations and concepts that are most important and necessary to be noticed. "The mind's eye does not readily give a visual ordering to colors, except possibly for red to reflect higher levels than other colors." (Tufte, 1983, p. 154)

Balanced proportions in everything: For consistency of informational value, the images / symbols should be proportioned according to the rest of the game components. "Graphic elements look better together when their proportions are in balance." (Tufte, 1983, p. 184)

Photography for complex ideas, illustration for simple ones: Photographs should be used only when illustrations fail to communicate, and illustrations could be used together with numbers, titles, and words to become more powerful. According to Banks & Prosser (1998) the full effect of a photograph is experienced by implementing a textual component [such as a caption] to support the visual and creating a dialog between text and image.

2. Content of Planet Play

Find the fun in the serious: Taking the subject of environmental awareness and the information contained in the Alberta Elementary School Science curriculum, and exploring them for fascinating trivia, which there is plenty of. “In the case of designing an original educational game, start with the fun – not in game mechanics, but in content. Every subject has aspects that are interesting, exciting...” (Brathwaite, 2009, p. 250)

Keep the difficulty balanced with diversity: The information contained in the questions used for the game should be diversified along the difficulty scale, from simple questions to advanced ones, so as to not become too challenging or too tedious for the players. “When the play is balanced, it provides a consistent challenge for its target audience.” (Brathwaite, 2009, p. 12)

Apply constraints: Limitations should be set on everything – the time allocated for playing the game, the game’s target audience and potential production cost, as well as the type and amount of content to be included. “Constraints are the confines in which designers build games.” (Brathwaite, 2009, p. 20)

Rewards, clues and alternate solutions: By creating a game mechanic that “offer[s] a reward structure” (Brathwaite, 2009, p. 250), the “lasting and learning power of the game” (p. 250) intensifies. Clues included into the multiple choice answers and alternate solutions can “reduce player frustration” (p. 48); if the question is too complex, it can be worked out by carefully listening to all the information, which contains clues to a correct response.

3. Mechanics of Planet Play

Create a clear game theme / core: The theme of environmental awareness must clearly be understood from the title – “a game such that it tells you what it’s about in the title alone” (Brathwaite, 2009, p. 160), as well as a simple explanation summary of the game’s idea and purpose – “if you can’t sum up your game in two sentences, you don’t have a game.” (p. 6)

Simplicity of rules and shorter playing time: Levels of complexity and length of play could always be added to the game after playtesting the prototype, however without a fully functioning simple core mechanic and a quick-running play experience, the game would not run smoothly during its initial testing stages, which would conceal the real operational bugs that would need to be fixed and improved in the future. “Simplify, simplify, simplify. Remember the target audience. Reduce the complexity of your rules wherever possible...modify your rules further to keep the playing time around 30 minutes or so...(Brathwaite, 2009, p. 115) so as to not outlive the attention span of youngsters.” (p. 111)

Use chance dynamic rather than strategy dynamic for children: Designing a game with the dynamic of chance rather than strategy, will allow the children to focus on the information in the question cards, rather than planning their next move. “Balancing luck and skill is a critical task, and to do this, it is necessary to understand the target audience...the level of skill involved must go hand in hand with the degree of complexity.” (Brathwaite, 2009, p. 110)

Draw on former experience with games: By creating a game prototype that combines techniques, which are familiar to the target audience, the game will be quicker and less threatening to learn and relate to. “Take the games kids already play and modify those to your advantage by adding an educational component ...in order to capture students’ attention, use the games they know, and take advantage of pre-existing game designs.” (Brathwaite, 2009, pp. 252-3)

Strive to create the magic circle and flow: The materiality, content and mechanics of the game should be designed in a manner such, that players would feel like their game world is in fact their real world, entering “what’s known as the *magic circle* when [they have] fallen...into the game world; good games have a stronger pull because they integrate players and their decisions into the experience” (Brathwaite, 2009, p. 83). The game should also be designed to offer players a balance leading to an “optimal play state”, otherwise known as *flow*; *flow* is an state of a balance between education and entertainment, where “as we succeed in mastering patterns thrown at us, the brain gives us little jolts of pleasure. But if the flow of new patterns slows, then we won’t get the jolts and we’ll start to feel boredom. If the flow of new patterns increases beyond our ability to resolve them, we won’t get the jolts either because we’re not making progress.” (Koster, 2010, p. 98)

VISUAL ANALYSIS

By collecting and analyzing existing games during the three stages of my visual analysis process, it was possible to examine game anatomy, content, and mechanics in a thorough manner, as well as to witness the concepts observed from the literature materializing in the different games that were evaluated. The key concepts of game development basics were all present to different extents within the 30 environmental games; these concepts were the foundation on which the trends projected by the matrices of the visual analysis could be placed. The most prevalent trends of educational environmental games that were taken from the visual analysis and applied to the design [materiality, content, mechanics] of *Planet Play*, were as follows:

Materiality of Planet Play

A Euro-style environmentally themed board game [e.g. *Catan Scenarios*, *Bioviva*], containing educational trivia [question & multiple choice answer] cards [e.g. *Eco Squad*, *Eco Planet*, *20 Questions*], dice, character pawns, and a reward system in the form of money or points [e.g. *Earthopoly*, *Bioviva*, *Terra*, *Eco Planet*, *Dirty Water*]. The target audience of the game would be children between the ages of nine and eleven years, attending the fourth grade of an elementary school in the province of Alberta. The game would last between 60-90 minutes in total, but should be simple enough to be explained and played within 30 minutes during the prototype play-testing session.

Content of Planet Play

The information content of trivia cards would be environmentally themed and based in part on the material provided by the school’s curriculum and in part on existing environmental games; the content of the trivia cards would be designed to include a balance of flora, fauna, natural resources, environmental threats and dangers, as well as preservation techniques. A message of saving the planet or saving the environment should be subtly integrated into the trivia cards, so as to not overwhelm [e.g. *Terra*]. Answering the questions both correctly and incorrectly would provide the players with environmental facts and figures in a memorable and engaging manner [e.g. *Bioviva*]. A localized real world would be present in the game, either in the content of the questions, or the materiality of the game components, or both.

Mechanics of Planet Play

The game mechanics would be designed to revolve around the dynamics of race to the end by collecting or accumulating a necessary amount of points / money / tokens [*Bioviva*, *Earthopoly*, *Dirty Water*, *R-Eco*]. Survival dynamics could be implemented, however should not become the focus of the game [*Eco-Fluxx*, *Terra*]. The goal and winning conditions of the game should include being the first player to reach a required amount of points / money / tokens, as opposed to being the last player to stay in the game. Such a condition will switch the dynamic of the game from a competitive to

a collective one. Players would represent themselves, as opposed to being given a pre-designed character pawn.

WORKSHOP 1

The materiality, content, and mechanics base for the *Planet Play* prototype was constructed from game development theory and visual analysis trends; it was completed by the data gathered during the first workshop. Determining the amount and type of environmental knowledge that participants were familiar with, as well as their preferences and suggestions regarding environmentally educational games, was achieved via administering the question cards, mind maps and testing *Earthopoly*, *Bioviva*, *Eco Fluxx*, and *Eco Squad*; this process allowed for a practical and personal understanding of the games to occur. The most dominant opinions, preferences, and suggestions expressed by participants were established during the data analysis process and applied to the design [materiality, content, mechanics] of *Planet Play*; the workshop feedback trends, particularly suggestions for improvement were as follows:

1. Materiality of Planet Play

QUESTION CARDS AND MIND MAPS:

Animals:

Integrate animals as a visual component into the game, such that players can create their own as they see fit, without affecting the dynamic of play or any of the game's informational content.

Concerns and Dangers:

Integrate a visual indication of environmental concerns, threats, and dangers into the game, such that players can understand the topic is constantly present during the course of play.

Characters:

Allow for characters or character pawns to be customizable by players without affecting the dynamic of play or any of the game's informational content.

Environmental symbols:

Integrate the symbols for recycling and waste management / water, energy and natural resources / animals and plants / threats and concerns into the visual components of the game.

GAMES:

Earthopoly's game board structure, *Bioviva*'s trivia cards, *Eco Squad*'s environmental symbols.

2. Content of Planet Play

QUESTION CARDS AND MIND MAPS:

Animals:

Information and questions about animals were most popular with participants, when compared to all other topics of environmental trivia; therefore, in order to sustain excitement and a strong attention span, include animal related information and questions more frequently than other topics.

Concerns and Dangers:

Natural and man-made disasters, as well as environmental deterioration facts and figures were the second most popular theme among participants. Include a section on trivia related to environmental concerns and dangers.

Environmental symbols:

Include sections of trivia related to recycling and waste management / water, energy and natural resources / animals and plants / threats and concerns, matching the visual symbol and game component for each section.

Design Process: Rough Prototype of Planet Play



Questions with entertaining and memorable facts:

Environmental facts and figures that are presented in a relatable and tangible format will be remembered easier and longer by the players; therefore, create the informational components to be unexpected and engaging.

Simplified trivia:

The length and complexity of the questions should be accessible to young children with a wandering attention span. Summarizing concepts and utilizing basic vocabulary is essential during the creation of the questions.

Simple rules:

The explanation and understanding of the game rules should be as simple and quick as possible.

GAMES:

Bioviva's trivia: The question cards of *Bioviva* are varied and dense in environmental trivia, much of which could be used as a great starting point for the creation of trivia intended for *Planet Play*. Moreover, the structure of the questions in *Bioviva* is another excellent source of design inspiration for the *Planet Play* prototype;

Eco Fluxx's threats and dangers: Participants responded very well to the cards representing environmental threats and dangers and the ability of the cards to derail a player's advancement in the game. As mentioned previously, integrating trivia related to environmental threats and dangers would facilitate the players' understanding of every action having a consequence, as well as spice up the rest of the environmental trivia;

Eco Squad's problem / solution approach: One of the most popular and effective techniques of *Eco Squad* was finding solutions to problems that were posed by the game. Participants felt involved and seemed to respond well to the cause-effect dynamic of the game, understanding that for every problem there exists a solution.

*3. Mechanics of Planet Play:**QUESTION CARDS AND MIND MAPS:**Environmental symbols:*

The four symbols [recycling and waste management / water, energy and natural resources / animals and plants / threats and concerns] were popular with participants not only visually, but also as a potentially powerful mechanism of the game's rules. Integrating the four symbols into the dynamic of *Planet Play* would be consistent with the materiality and content preferences of the participants regarding the symbols.

Questions with entertaining and memorable facts:

By shuffling the deck of question cards prior to commencing the game, as well as including questions with entertaining and memorable facts into the game's content more frequently than other types of trivia, would ensure a strong game *flow*. Players should feel excitement on each turn prior to hearing the questions, always expecting the question to surprise them with memorable and unexpected trivia.

Faster pace:

For *flow* to successfully continue throughout the game, players should be able to each have their turns as frequently as possible, paralleling the length and complexity of the question trivia.

GAMES:

Earthopoly's roll-and-move dynamic: Encourages players to always keep moving and thus always feel involved in the game, even when they do not provide correct answers to questions and receive rewards for that;

Bioviva's reward format: Encourages player engagement and provides them with a sense of achievement [both materially and psychologically] for answering the questions correctly;

Eco Fluxx's survival dynamic: Encourages players to stay focused and attentive, as well as appreciate the positive and rewarding aspects of the game. The dynamic of survival or elimination was not fully employed in *Planet Play* – as the prototype was designed to be a collective, rather than a competitive game – however, players were provided with a taste of this dynamic via the content of the game, which included cards with environmental threats and concerns that detracted points from players and slowed their advancement towards the finish line down;

Eco Squad's open-ended dynamic: Encourages discussion among players, which leads to a deeper understanding of the material. The *Planet Play* prototype did not include an open-ended discussion dynamic when it was played as a single player game, however for multi player or team playing, the structure of the game's trivia and mechanics was such, that an open-ended dynamic could and would take place.

Prototype of Planet Play



COMPONENTS

The components of *Planet Play* were designed based on all the information discussed previously; all of the materials were printed on heavy recycled brown sketch paper, therefore the colors were absorbed more into the surface, becoming duller and less saturated. This effect was intentional, in order to achieve an eco-friendly look and feel of the game. The components of *Planet Play* were as follows:

Game board:

The *Planet Play* game board was round and measured 53cm. [21 in.] in diameter. The board was intended to be made out of thin cardboard, which would be bent twice – once in half and once in quarter, so as to be contained and transportable inside a potential game box. The *Planet Play* board was inspired by a combination of *Earthopoly* and *Bioviva*; *Earthopoly's* influence on the *Planet Play* board was the border circle traveling area, which contained all the category symbols [properties in *Earthopoly*]. The idea of folding the board into quarters came from *Bioviva*, as did the centrally located picture of the Earth's continents; traveling around the board as if it was planet Earth, was also inspired by *Bioviva*. The symbols depicted on the border circle of the game board repeated a total of five times each, always progressing in the same order – recycling and waste management / threats and dangers / water, energy, natural resources / plants and animals / disaster / *eco efforts*. The liner and repetitive progression was intentional, in order to simplify the mechanics of progressing around the board as much as possible. Furthermore, by repeating the symbols in a consistent manner, the *Planet Play* board offered players stability of play, only leaving to chance the rolling and question aspects of the game; the process was designed this way in order to attract full focus towards the content of the questions as opposed to the mechanics and dynamics of traveling around the game boards.

Character passports:

Blank freestanding cards, measuring 5.5x10cm. [2.1x3.9 in.]; the cards were freestanding by means of a simple triangular fold at the back of the card – an environmentally friendly solution, requiring no adhesive or additional components. The material of the cards was the same as the material, which the game board was created with – heavy recycled brown sketch paper. 30 cards were necessary in order to accommodate all the participants of the workshop, however if *Planet Play* would potentially be produced, the number of cards would significantly decrease [to ten], and be coated with a material that allows for prolonged use, where the characters



could be created with markers and erased to create new ones over and over again. This is a production issue to be addressed in the Limitations section of this document. The character passports were the only unpredictable and fully modifiable component of *Planet Play*, allowing players to express their creativity and become anything they wished to for the duration of their travels around *Planet Play*.

Dice:

A six-sided wooden cube, measuring 3.2cm. [1.26 in.] on each side; each face of the cube depicted a symbol representing each of the six categories of the game – recycling and waste management / threats and dangers / water, energy, natural resources / plants and animals / disaster / *eco efforts*. The cube was made from wood, the edges were filed down smooth, and then each of the six symbols was carefully mounted onto the faces of the cube. Similarly to the *Planet Play* game board, the dice was also created with simplicity and consistency in mind, so as to visually and conceptually connect the board, the dice, and the question cards.

Goal cards:

A round card, measuring 8.5cm. [3.34 in.] in diameter. The *goal* card indicates the amount of *ecos* and the amount and type of *eco efforts* that a player must collect throughout the game in order to win. Inspired by the *Bioviva's* Destination cards, which indicated the amount and color of eco points that players required before emerging in winning capacity. The concept of a set goal to strive towards was integrated into the mechanics of the game in order to promote competition – the *goal* cards were in fact the only competitive element of *Planet Play*, which was certainly designed as more of a collective rather than a competitive game.

Question cards:

A square card, measuring 8x8cm. [3.15x3.15 in]; the question cards contained environmental trivia pertaining to the categories of recycling and waste management / threats and dangers / water, energy, natural resources / plants and animals. Each question was carefully researched and information about the facts, figures, and claims was cross-referenced between different resources [environmental literature, Internet websites, encyclopedias and environmental board games]. If a piece of environmental trivia that I found became interesting and exciting for me, I would ensure it related to the Alberta Elementary School Science curriculum; if there was a connection and the trivia fit into the curriculum's requirements, the information would then always be cross referenced online, checking various sources for confirmation of accuracy. If at least two of the sources were conflicting on their measurements or claims, the information would not be included at all. [e.g. River depths, mountain heights, rainforest eradication areas, plastic consumption amounts, etc.] Every single question included in *Planet Play* was original, created from combination of facts and juxtaposition of figures. The same approach was taken with the *eco efforts*. By playing the game even just once, it was intended that participants should be able to cover all five of these environmental awareness issues via the question cards; while one separate question deals with only one particular category, a combination of different questions from various topics / sections arise throughout the game, ensuring a rounded perspective on all the issues.

Eco Effort cards:

A square card, measuring 8x8cm. [3.15x3.15 in]. The *eco effort* category of cards consisted of roughly 50 percent positive, environmentally friendly efforts and 50 percent negative, environmentally harmful deeds. The decision to create an equal amount of positive and negative *eco efforts* was made in order to remain in touch with reality, where the dynamic is similar – for every environmentally friendly action, there is an opposite reaction [and vice versa, where for every problem there could be a solution]. Furthermore,

to compensate for the game's otherwise rewarding mechanic, the *eco effort* would both offer and detract *ecos* from players; the question categories would reward players with *ecos* for correct answers in four cases [recycling and waste management / threats and dangers / water, energy, natural resources / plants and animals] and would only detract *ecos* for the category of disasters. Therefore, the game mechanic was such that *ecos* could be obtained more often than not. The *eco effort* section was designed to contain 50 different efforts and deeds [25 each], and some efforts repeated, creating a stack of approximately 80 cards.

Ecos:

A rectangular card, measuring 4.5x8cm. [1.77x3.15 in]. An element of reward was necessary to integrate into the mechanics of *Planet Play*, therefore influenced by *Earthopoly's* and *Dirty Water's* ecological monetary bills, the *ecos* were created. During the play testing of *Planet Play*, the participants' reception of *ecos* was excessively positive, which was considered to be a game flaw and will be discussed in the Workshop 2 analysis portion of the document. Overall, the *ecos* were fashioned to resemble money to an extent, however not directly referencing any existing currency. Each stack of *ecos* contained around 30 bills [90 in total] for the play testing session, however in reality would contain 100-150 [300-450 in total]. The *ecos* came in bills of 20, 50, and 100 – 20 was blue, 50 was green, and 100 was orange; the color choices were only intended to differentiate the amount of *ecos*, rather than link them to the content of question or *eco effort* cards. Furthermore, an assortment of *eco* amounts was created in consistency with the *eco efforts* and question cards, which were all worth different amounts of *ecos*. [e.g. a correct answer to a question from the plants and animals category could be worth 70 *ecos*, and if a player sorted their recycling from their garbage, then that *eco effort* would be worth 90 *ecos*; however if a player had the misfortune to roll and land on a disaster category that required to re-plant a forest after a forest fire, the player would be penalized 120 *ecos*.]

A list of *eco efforts*, disasters and questions from question cards can be found in the Appendices.

RULES

1. Begin by creating your character passport. Your character passport can be anything you want it to be; you may write only your name, or illustrate a full body, face, and clothing of the character. Your character could be as real or as imaginary as you want it to be, a human, plant, animal, object, etc. Give your character a name. Spend no more than 2-3 minutes on creating your character.

2. Pick a *goal* card from the stack of *goal* cards; this card indicates the amount of *ecos* and the amount and type of *eco efforts* that you must collect to win the game. When you win an *eco effort* or earn *ecos*, keep them next to your *goal* card.

3. All players begin at *GO!* – during the game, each time a player reaches and passes *GO!**, they will be able to select an *eco effort* of any color from the *eco effort* stack to add to their collection, which is kept by the *goal* card.

4. Whoever calls it, goes first.

5. Roll the dice; whatever symbol comes up on the dice, move your character passport to the one that is nearest to you on the *Planet Play* board.

6. Question time**! The questioner picks the top card from the question card stacks category that corresponds to the symbol rolled by the player. The questioner reads the question and the answer possibilities to the player and then waits for a response. If the player answers correctly, they are awarded the amount of *ecos* *** that the question was worth. If the player answers incorrectly, the questioner reads the correct answer along with the trivia that follows underneath, but gives no *ecos* to the player. The questioner puts the question card face down, at the bottom of its category stack.

7. The questioner becomes the next player to roll the dice.

8. The player rolls; the dice lands showing a category symbol; the player moves their character passport to the category symbol on the *Planet Play* board; the player sitting next to them picks up a question from the corresponding category, reads it and gives *ecos* for a correct answer, etc. The first player to reach the amount of *ecos* and the amount and type of *eco efforts* indicates on their *goal* card, wins the game.

9. *Eco Efforts*: If a player rolls an *eco effort* category question, they move to the *eco effort* symbol that is nearest to them on the *Planet Play* board [same action as for all the other symbols]. The questioner picks the top card from the *eco effort* stack and reads it out loud to the player. The player then takes the card from the questioner and keeps it for the duration of the game, adding it to their collection of *eco efforts*. If the *eco effort* rewards the player with *ecos* for an environmentally friendly effort, the questioner distributes the required amount from the collective stacks of *ecos*. If the *eco effort* punishes the player for an environmentally unfriendly deed, the player hands over the required amount of *ecos* from their collection over to the collective stacks of *ecos*.

10. *Disasters*: If a player rolls a disaster category question, they move to the disaster symbol that is nearest to them on the *Planet Play* board [same action as for all the other symbols]. The questioner picks the top card from the disaster stack and reads it out loud to the player. The disaster category always requires the player to hand over the required amount of *ecos* from their collection over to the collective stacks of *ecos*.

* Reaching and passing *GO!* rewards the player with an *eco effort* of their choice. The player clearly states the color of *eco effort* they need from the stack; the player then proceeds to go through the *eco effort* stack, taking off *eco effort* cards one by one, until the requested color appears. The *eco effort* cards that do not meet the color requirements are immediately put back in to the bottom of the stack, face down. If the *eco effort* is a negative deed card, this is the only time in the game when the player gets to keep it without paying a penalty into the collective stack of *ecos*.

**The role of the questioner moves clockwise around the table – the player sitting next to the player rolling the dice is the first questioner.

*** *Ecos* are kept in stacks [20, 50, 100] in the middle of the board. Whoever is the questioner for the round, is also the distributor of *ecos*.

11. The question cards should always be shuffled very well prior to beginning the game. All card categories / stacks are to be facing with their writing side down and symbol side up.

12. The question cards should always be arranged according to their categories, which should always stay separate from each other [six stacks in total].

FUTURE DEVELOPMENT

In the case of *Planet Play* ever being marketed and produced, the idea behind the game's trivia cards was to update the questions yearly, adding fresh information to the existing trivia. Potential players would purchase the *Planet Play* set – game board, dice, character passports, *ecos*, and the three varieties of cards [recycling and waste management / threats and dangers / water, energy, natural resources / plants and animals; the disaster cards, and the *eco effort* cards]; after playing the game and becoming familiar with all the trivia, players would be able to purchase additional sets of trivia cards for recycling and waste management / threats and dangers / water, energy, natural resources / plants and animals. The disaster and *eco effort* cards do not lead to a game dynamic, where the player discovers all the correct answers, which diminishes their *game flow*; therefore, the *eco efforts* and disaster cards can remain the same without changing the dynamic of the game and do not require regular updates. Furthermore, *Planet Play* could be easily converted into digital format, becoming both a single player and a multi player game; in the case of being considered for a digital platform, *Planet Play*'s question cards could be updated indefinitely [so long as there is someone out there dedicated to researching and designing the content], and the entire experience could potentially be free of charge.

WORKSHOP 2

The play testing process was structured in accordance with the literature, specifically *Rules of play*, *Challenges for game designers*, and *Game design workshop: A playcentric approach to creating innovative games*. The second workshop lasted for one hour and was separated into two sessions: thirty minutes of game playing were followed by a 20-minute reflection session, with ten minutes to set up. After having met with the workshop facilitators once already, the participants were very active and relaxed in their interactions with our team.

Three groups were formed out of 30 participants. A group of six, to demonstrate how the game could be played with a small number of individual participants; a group of ten, to see how *Planet Play* could be played with a large number of individual participants; and a group of 12, where participants formed six groups of two, thus demonstrating how the game could be played in small teams.



The time allocated for the first half of the workshop – playing the *Planet Play* prototype – was distributed roughly as follows: the first 15 minutes were spent understanding the game, forming characters and settling into the flow of moving around the game board. The last 15 minutes were spent on playing the game, with participants becoming more engaged in the overall process of the game and attentive to their group leaders [facilitators].

Character Development

Participants were given blank freestanding game cards [referred to as *character passports*] along with colorful markers, and asked to create their characters for the game. No specifications or special requirements were set regarding the visual or thematic nature of the characters and participants were absolutely free to run with their imagination, inventing any character they desired, as long as the characters would fit onto the surface of the cards provided. Guidance was only offered in the form of leading sentences, like “anything you want to be, plant, animal, or even creature with super powers...any color or shape...give the character any name you’d like, it could be your name or just a name you like”. Participants in the group of 12 [which consisted of six teams of two] were asked to collaborate on creating a character that would be enjoyable for both of them, thus characters from the third group were mostly duo / multi-colored, unlike the characters from groups with individual players, which were monochromatic. The amount of time assigned to creating the game characters was limited to a maximum of four–five minutes, so as to be sufficient for inventing, discussing, and depicting a simple character, but not overly long so as to not over-complicate the characters with unnecessary detail, thus detracting time from actually playing the game itself. The names given to characters were almost always the names of participants, which is information gathered from directly asking the participants about their character in the course of the session; however, seeing that this study examines anonymous group results, the names of the characters in their relation to individual participants will not be discussed any further.

Playing the Game

The rules of *Planet Play* were briefly explained to the groups by their facilitators as follows: “you are each given a *goal card*, which tells you how many *ecos* and *eco efforts* you will need to collect during the game to win. The *ecos* look like this and come in three varieties: 20, 50, and 100; you will each begin the game with 100 *ecos*. The game board is divided into six categories; each category is represented here on the dice, so you will roll the dice and whatever picture comes up, you will move your character and place it onto the closest category which you rolled. After you land on your



category, I will read to you the question from the category card and you will answer the question. If you answer correctly, you will get *ecos*, if you land on the *eco effort* category, you will get an *eco effort* point for doing positive *eco efforts* or lose *ecos* for doing environmentally unfriendly deeds". The facilitators then asked participants to begin playing the game and answered any questions that arose along the way.

Upon ending the play testing of *Planet Play*, research facilitators asked their groups for feedback about their experiences, preferences, and suggestions regarding the game. Each facilitator was provided with a question sheet, consisting of 17 questions, which can all be found in the Appendices, Ethics Application, Documentation, Workshop 2: Game Feedback Questions.

The data collected from the workshop in the form of my observations in conjunction with the reflections of facilitators and the feedback from participants, is discussed below.

ANALYSIS OF WORKSHOP 2

Playtesting *Planet Play* with participants brought to light a number of unexpected reactions, which all made for useful feedback that would be applied to the refining of the game prototype. As mentioned in the previous section of the document, at the beginning of the workshop participants were divided into three groups and the rules of *Planet Play* were explained to each group by the research facilitators, upon which playing the game began. Participants were feeling comfortable in the presence of our team – having met all of us only three weeks ago for the previous workshop – and expressed much excitement to start playing the game.

Materiality

The materiality of *Planet Play* is analyzed in continuum with the previous analysis of *Earthopoly*, *Bioviva*, *Eco Fluxx*, and *Eco Squad*. The same approach of analysis and similar questions were posed to the *Planet Play* prototype, as they were to the four previous games; thus, the process of playing the game, the game itself and the reactions of participants were evaluated. Color is always the first visual element to analyze, as – according to the literature – it is the first thing that people react to; the colors used in *Planet Play* were commented on as soon as the games were assembled on the classroom tables by the research facilitators. Participants expressed a generally positive reaction to the game board and the question cards, however it was the dice that was their favorite; the materiality of the dice and the visual elements were highly praised by all of the participants, both verbally and as indicated by their actions and attachment to the components of the game. All components of *Planet Play* were printed on recycled heavy paper, therefore the colors were slightly muted, as the ink became easily absorbed into the surface of the paper. Participants reacted to this as well, commenting on and asking about the dullness of the *Planet Play* colors. Overall, there was a collective desire for brighter and sharper colors, which is something that would be addressed during the refining of the prototype.

The notion of a game being made from recycled components – as well as the tactile experience of the components of *Planet Play* – did not appear to be of great significance to the participants, who displayed similar reactions to *Earthopoly*, *Bioviva*, *Eco Fluxx*, and *Eco Squad*, where the awareness of a game's eco-friendliness did not change the course of play or inject special enthusiasm into the players. The materiality of *Planet Play* was therefore more appreciated in terms of the visuals used in the game [the shapes and colors of the components], and was thus a source of physio-, rather than socio-pleasure for participants.

The four previous games examined with participants were all dense with imagery, which led to participants primarily exploring the imagery, rather than focusing on the content of the questions or scenarios of the games; this issue was addressed during the conception and design of *Planet Play* and the imagery was simplified. According to the literature on information design and the principles of visual communications, the images created for *Planet Play* were abstract and repeated along the game board and on the question cards for emphasis and better information retention. The central image of the game – the world's continents in the middle of the *Planet Play* game board – was generally appreciated by the participants however did not dominate their focus; when and if asked about it, participants would respond positively, however did not volunteer their opinions independently. Since the center of the game board served as an enclosing area for the game's components, the image located there was mostly covered by question cards, *ecos*, and dice during play; the participants acknowledged the image, yet did not focus on it, which indicated that the layout of the game board was

effective – as it served the purpose it was intended for – and could therefore be kept almost the same during the game refining process.

Similarly to their reactions to the game board, participants did not request any specific changes in the images of the other game components and seemed content with the images overall. Participants suggested an increase in the size of the *Planet Play* game board, which was a direct response to the size and location of their character passports; even though participants greatly enjoyed creating their character passports and were very focused on them throughout the game, the lack of space for the character passport cards on the *Planet Play* board proved distracting for the game. Participants were focusing their attention and energy more on the location and position of their character passports instead of the content of the questions; the proportions of the character passports were too large in relation to the game board, which resulted in a chaotic arrangement of the cards on the board throughout the duration of the workshop.

The main words that were used for summarizing *Planet Play* – which repeated the most out of all the other descriptors – were “fun” and “too short”. Throughout both the playtesting and the feedback sessions, *Earthopoly* was referenced very frequently; participants were clearly very affected by the game from the previous workshop and were eager to play *Earthopoly* again, asking when that would be possible. When questioned about the differences between *Planet Play* and *Earthopoly*, as well as about the preferences of participants regarding either game, the participants were strongly inclined towards *Earthopoly*, explaining their desires with “it has money” and wanting “to be rich”. This was the most unexpected portion of the workshop, however very beneficial for future refinements of the prototype and for the creation of educational games in general. The reactions of participants were clearly signifying that any educational game would require to stimulate the players on either a purely educational, non-materialistic level, or – like *Earthopoly* – offer a recognizable monetary variable into the mechanics and dynamics of the game. However, a game that aimed at connecting educational values with a vague representation of play money – such as *Planet Play* – would appear to be unsuccessful, as it would be nor here, nor there, arousing interest in the players regarding their potential to “be rich”, which would in turn distract from the content and environmentally themed purpose of the game.

Content

During the visual analysis and the first workshop, the content presented by *Bioviva* and *Eco Squad* was evaluated to be the most educational out of all the other board games examined; the trivia in *Bioviva* was also the most diverse in comparison to the other games, and its structure set a positive example for *Planet Play*. The content of the game was strategically separated into flora and fauna, environmental threats and dangers, environmental preservation techniques, waste management techniques, and natural resources, all categories taken directly out of the first workshop; there were also two additional categories that were not structured as questions, yet as statements, the first category was natural and man-made disasters and the second was eco efforts [a detailed description provided in the prototype design section of this document].

Participants were most responsive to the content related to natural and man-made disasters as well as flora and fauna. The content of natural and man-made disasters appeared to fascinate participants mostly because of its mechanics, rather than the information it presented; the mechanics of the disaster cards always required players to lose *ecos*, so as to compensate for a natural or man-made disaster; participants were preoccupied with amassing the highest amount of *ecos* and were therefore pleased to see other players fall behind due to the disaster cards. Furthermore, because

the information in the disaster cards was formulated as statements rather than as questions, this would always lead to some sort of eco transaction, regardless of participant contribution; therefore, it could be assumed that participants enjoyed the dynamic of the game when more action was taking place, rather than when they were required to wait their turn while the other players answered a trivia card.

Eco efforts were created in order to offer players an opportunity to be rewarded for environmentally positive actions [e.g. recycling used plastic] or penalized for environmentally unfriendly negative deeds [e.g. leaving the room with the lights turned on]. By landing on the *eco effort* category, players could still acquire important information about the environment without having to answer questions to obtain *ecos*; this technique was also implemented so as to provide diversity of play. Participants appeared more attached to the *eco effort* category than they did to the four question categories, presumably for the same reason as described above regarding the disaster cards.

The trivia of the question cards did not appear to be complex for participants to understand and follow, however the length of the questions and the time required to listen through the questions before answering, was definitely an issue. The size of groups playing *Planet Play* was much larger than it should have been, therefore the focus of participants was quite scattered, which hindered the understanding of questions and more importantly the potential to achieve the state of flow and peak performance. As discussed in the review of the literature and mentioned in the prototype design section of this document, the states of flow and peak performance could only be achieved if the concentration of the player is engaged in the process of the game for a continuous time period, without distraction or leaving the *magic circle* created by the structure and dynamics of the game. The large size of groups, duration of the playtesting session, noise levels, proximity of groups to one another, and issues with the prototype itself, all translated into road bumps on the way toward achieving the state of flow. Participants did, however, indicate that the trivia used in *Planet Play* was memorable to them, as upon completion of the games, a number of participants were overheard engaging in conversation with one another, sharing the facts they learnt in the course of playing the game. For instance, one participant questioned her friend about the largest mammal in the world, which was a question taken straight out of the plants and animals category of the question cards; the conversation between the two participants mentioned above led to a discussion of a small group of participants, which was an indicator of *Planet Play*'s potential as an educational tool that promotes awareness through inquiry.

The trivia of the question cards appeared to be much more effective in engaging the attention of participants when the question cards were read more than once, thus repeating the trivia either in the same format as it was initially structured, or simplifying it by only pointing out the main elements. [For example, if the question card was in the plants and animals section and posed the question "Squirrels are environmentally unfriendly, dangerous animals. Yes that's true or no, no way!" then this question could be read as is the first time around, and then immediately repeated as "so are squirrels dangerous? / so are squirrels bad for the environment?"] Thus, the information in the question that was most structurally and contextually important would be highlighted, which could enhance the memorability of the information as well as simplify the question into its purest form, facilitating the speed of associative and cognitive connection between the information in the question and the brain. Facilitators were continuously encouraged to use this technique during the course of the game as they were reading out the questions from the question categories; moreover, it was observed that in every case of simplifying and repeating the question,

participants would immediately become much more focused on the question and engaged in the process, regardless of the question category or the group of participants. The repetition-simplification approach would be integrated into the refined rules of *Planet Play*, and facilitated visually in the refining of the question cards by altering the necessary words either by changing their color [to match the color of the category] or by changing their weight [italicizing].

Overall, the content of *Planet Play* was created with a strong consideration of entertainment, both by including memorable unusual environmental facts and figures and by using playful wording in structuring the questions. As observed from the literature, organized ludic activity and ludic components aid learning and information retention, therefore by aiming to always increase the entertaining aspect of educational material, the material could in the short term become more engaging and desirable to learn and in the long term provide positive associations and triggers within the long term memory, thus enhancing and solidifying understanding.

Mechanics

The mechanics of *Planet Play* relied on symbols and imagery for the game to function, which was one of the reasons behind creating the imagery to look as simple and abstract as possible, so as to not pull focus away from the content of the game. The game was structured around a play dynamic combining chance and strategy; the rules of the game involved players rolling the dice and landing on one of the six categories of *Planet Play*, which was an activity that they all seemed to very much enjoy. The rules did not appear to be complicated or difficult for participants to understand, and aside from the distractions provided by the large size of player groups and their proximity to each other, the game play progressed along the set rules. The pace of the game was on the slow side, which once again was caused by the distracting nature of the set up of groups, however the smallest group of players [six participants] appeared to be focusing on the questions and following the rules of *Planet Play* more so than the other two larger groups.

One of the groups was given *Planet Play* with decks of question cards that were not properly shuffled prior to commencing the game; this led to a game dynamic where one of the participants continuously lost *ecos* after rolling the disasters and threats categories. Since the rules did not account for such a situation, the game dynamic for that participant was shifted into an unfavorable direction and an unenthusiastic experience; this situation provided constructive criticism of *Planet Play*, pointing out the hole in the rules and making it a necessary adjustment to implement during the refining of the prototype. To avoid negative game dynamics from occurring too frequently – as they are caused by chance and not strategy, they are bound to always be present in the game – two changes could be made to the rules. First, all players should begin the game with a set amount of *ecos*, accounting for a finite number of negative cards to appear in their game, thus allowing players to be able to draw the necessary amount of *ecos* that the card penalizes them for, from their initial personal stock [as opposed to entering a minus amount of *ecos*, not being able to participate in the game]. A dynamic of negative cards appearing in the game is not at all uncommon, as explored by game designers and theoreticians, such as Brathwaite and Salen & Zimmermann; furthermore, a partially negative / losing dynamic is realistic, given the subject matter of the game [disaster cards and negative *eco efforts* are a natural occurrence in real life, therefore their implementation into *Planet Play* is not unexpected]. The second change to implement into the rules of *Planet Play* so as to avoid a continuously negative dynamic, is the idea of a collective rather than personal loss; a player who is continuously unlucky to land on negative categories that penalize them with a loss of *ecos*, would initially exhaust their own personal stock of *ecos*

– provided to them at the beginning of the game and accumulated through answering questions correctly or landing on positive *eco efforts* – upon which, the player must take *ecos* from other players of the game, thus instilling a dynamic of collective consciousness and collective loss for negative deeds. Such a solution would correspond with all the environmental preservation information discussed in the literature, as environmentally unfriendly deeds of an individual translating into a problem that is eventually collective and no longer personal.

During the workshop – for reasons mentioned previously regarding the chaotic set up and distraction factors – players were mostly engaged independently and paid attention to the questions when it was their turn to answer. A dynamic of collective engagement of attention could be implemented into the game, where *ecos* could be given to any player who answers a question from the four question categories correctly. For example, in the case of a player – whose turn it is – not knowing the answer to a question, the player next to them [or any player who calls it] could attempt to answer the same question; in the case of a correct response, the player who provided the response could be awarded *ecos* without it being their turn. Such a change would require the question format to change from true / false into multiple choice, which would fundamentally change the game; however this could be a consideration for future developments of *Planet Play*.

Summary of Workshop 2

In order to refine the *Planet Play* prototype, suggestions made by workshop participants will be combined with observations from the workshop and the experience of the initial prototype design process. The following changes will be made to *Planet Play*:

- Increase the size of the game board, particularly the outer cells, so as to allow more space for character passports;
- Slightly decrease character passport cards, leaving the size large enough to draw on comfortably, yet not so large as to take up unnecessary space on the game board;
- Keep the six symbols and the game board image and layout as they are, however print everything in brighter and more saturated colors, possibly using a lighter colored or thinner card stock;
- Re-design the *ecos* to look less like money and more neutral [possibly large and round, to resemble the game board];
- Adjust the rules of the game to specify a number of players [minimum two and maximum six people, best when played with four];
- Adjust the rules of the game to instruct players to always shuffle all the cards – within their respective categories – prior to commencing the game;
- Adjust the rules of the game to instruct players to begin playing the game with a set amount of *ecos*, in case negative cards keep coming up at the beginning;
- Adjust the rules of the game to require players reading the question cards to read the card twice and / or re-read the italicized words after reading the card for the first time, so as to draw focus to the content and simplify the question as much as possible;
- Adjust the rules of the game to require players who are losing *ecos* due to their negative deeds – yet have none left to contribute to

the collective pile – to take *ecos* from the player to their left, thus dragging others down with them and introducing the concept of a collective loss;

- To engage the attention of all players, *ecos* will be given to any player who answers the question correctly, in the case of the player whose turn it is not knowing the answer. This would require the question format to change from true / false into multiple choice, with at least three answer options, thus allowing other players to answer the question that could not be answered by the player whom the question was originally intended for.

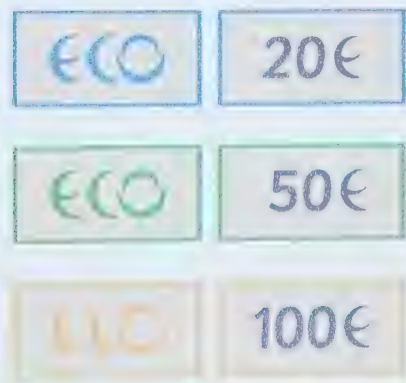
For all game components and photographs of the display, please see Appendices, Planet Play Prototype and Display.



Original prototype of the Planet Play board



Refined prototype of the Planet Play board



Original Ecos



Refined Ecos

DISCUSSION & LIMITATIONS

The design research project is discussed in terms of a framework for creating an educational game, as well as parts of the game prototype itself; unplanned outcomes and unexpected situations, which took place during the different stages of the project are evaluated. The main* limitations – related to workshop and playtesting – are incorporated into the discussion, spanning from physical conditions to game mechanics and materiality.

WORKSHOP 1

While the duration of the first workshop was almost too short, participants were nevertheless given overall a sufficient amount of time allocated to each of the four phases. The first phase – interviews, where participants asked each other environmentally related questions from question cards and recorded their answers in written or pictorial format – did not need to be extended, providing enough time to retain a balance between understanding the workshop process and being involved in it. The second phase – mind maps and brain storming – was conducted without difficulty and according to plan, similar to the first phase of the workshop. Data gathered from the first and second phases was very generous in content, both visually and informatively, thus offering a major contribution to the design of the *Planet Play* prototype.

The duration of the third game-playing phase was too short and for future research, it is suggested that the time be extended to a minimum of one hour instead of the original 30 minutes. Ideally, the games would be introduced to participants, the process of play would be observed, and feedback recorded – exactly as was done during the workshop – however afterwards, the games would be left with participants for use in their personal time [a few weeks], to allow participants to become familiar with each game in a non-rushed setting. Feedback could be collected about the game twice, once to record and analyze the initial responses of participants to the games and the second time after the games have been experienced by participants in depth, not as experimental workshop components. The same approach could be suggested for playtesting the *Planet Play* prototype, thus making the data collection and analysis process richer and more informative.

WORKSHOP 2

The second workshop did not proceed as smoothly as the first one, mainly because participants were familiar with our team, behaving in an excitable manner, and were therefore more difficult to direct along the organized structure of the workshop. Nevertheless, the unpredictability of the second workshop facilitated the understanding of changes that were necessary to be made to the prototype and to the overall process of conducting a playtesting workshop for future reference and research.

Number of Players

It would appear that participants were very energetic and active, possibly because their groups were too large in size and located too close together. This condition led to the suggestion for a major adjustment of *Planet Play* and its rules, where only six players shall now be recommended per game, with an ideal playing number between three and four. During the preparatory period – prior to playtesting *Planet Play* – when adults [research

*NOTE *Limitations that were less significant [to the overall structure of the research project and framework] are discussed within their respective categories. For instance, the limitations of the visual analysis are integrated into the Visual Analysis portion of the document, and the detailed proceedings of the workshops are analyzed within the sections related to each workshop. The suggestions for the improvement of the 'Planet Play' prototype are discussed in the Prototype section of the document.*

facilitators] were learning and playing the game, the number of players was five people; this number could potentially fluctuate towards an increase, as the attention, focus, and noise levels of the group were much easier to monitor. However, as *Planet Play* is intended to be an educational tool for children – and created around information in their science curriculum – the number of players would therefore be advised with the consideration of the age and behavior range of the target audience. Thus, following the playtesting experience of the second workshop, a maximum of six players is recommended for *Planet Play*, so as to capitalize on the educational potential of the game in a non-hectic and focus-oriented environment.

Components

The eco reward points or *ecos* of *Planet Play* appeared to engage the participants to the highest degree as compared with any other aspect of the game; the understanding of *ecos* to be play money [similar to *Earthopoly*'s play money] was a very exciting concept for the participants, who collected them with enthusiasm and were very concerned with losing them as opposed to being concerned with answering a question wrong. This was by far the most significant and least anticipated issue with the design of *Planet Play*, since it appears that incorporating play money – or even an element that appears like play money in its shape, form, and function – defies the purpose of the game as being educational. Therefore, it could be suggested that a game, which intends on being an educational tool and incorporates a reward system into its mechanics and dynamics, should stay clear of similarities and recognizability with money, when visually representing the reward component. This could be achieved by avoiding rectangular paper-based game components with numbers and symbols on them [visual association with monetary bills] or circular coin-size tokens. *Bioviva* could be used as a successful example of a game with a reward system, as it seems to have a perfect balance of offering players rewards without creating financial associations; tokens are designed as in a way that intensifies the environmental message of the game, linking the tokens with environmental trivia and promoting environmental awareness among players.

Overall, the workshop and the game could be considered effective, if the technical difficulties – which were caused by the duration of the workshop, the number of participants per group, as well as the problems with the components and mechanics of *Planet Play* – could all be identified and addressed as positive insights into the improvement and refining of the framework for designing an educational game prototype. The workshops, particularly their occasionally unexpected proceedings and outcomes, have been most useful. The process of evaluating and categorizing games with a visual analysis was much more contained and directed, given that it was performed individually, under the same conditions and following the same procedures as were developed during the planning phase of this project. The addition of a human factor, especially the energetic contribution of child participants to the process, transformed the planned workshop proceedings. Understanding the limitations of the workshops can help to refine the framework for designing an educational game.

CONCLUSION

The overall process of creating a prototype of a game based on the combination of academic and participatory data led to a potential framework that could be used for the development of educational games in general and environmentally themed board games in particular. The limitations of this research project illuminated the changes necessary for refining the framework, focusing on the areas of the process that were successful and highlighting areas that required future adjustment. These changes include: an alteration of certain conditions of the data collection process [organizing the workshops in larger spaces and with a longer running time], aspects of the prototype [changing material components, such as the game board, *ecos*, etc.], as well as the time available for play testing and the possibility of frequent or unlimited access to working with child participants.

This design research project could be perceived not only as a first step towards the refining of the *Planet Play* prototype into a fully functioning board game, but also as a framework for the creation of an educational game concerning the subject matter of environmental preservation [for environmental preservation in the province of Alberta]. In regard to the research question, *Planet Play* united the concepts derived from the literature into the following: the research, development, and design of an educational game; a tangible object that became a game prototype; and a framework for developing and creating educational board games.

As a game – and even as a prototype – *Planet Play* was limited and could be improved in accordance with the feedback from participants, facilitators and my own observations and experiences with it. As a framework for the research and development of an educational game that promotes awareness about a topic, *Planet Play* was more effective. This was a process, from inception of the idea and formulation of the research question, through the visual analysis, workshop designs and data evaluation, to the design and playtesting of the prototype and its reception by the research participants; the entire process that could be modified according to the observations and limitations, and utilized as a method for uniting different subject areas into a tangible and practical outcome.

Considering that this was a design research project, the role that design played in this process was the most significant out of all the other disciplines explored in the literature review. The original intention of this project was to explore how a learning tool, such as an educational game, could be designed for and with children, while simultaneously promoting their awareness of environmental issues. The process led to an understanding of the steps that are suggested to follow in the creation of such a learning tool; beginning with amassing and reviewing existing materials [tools] by visually analyzing and categorizing them, followed by organizing user-centered or participatory workshops with the target audience of the learning tool. The workshops are observed, which guides and formulates the creation of the educational tool. It can be concluded that in order to create a functional framework for an educational game or the game itself, a much deeper understanding of the subject areas and the involvement of professionals from disciplines outside of design would be necessary. Designers could work together with child psychologists and environmental experts, collaborating with curriculum developers and game designers and theoreticians in order to bring such a project to its full potential.

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APPENDICES

Ethics Application

Visual Analysis

Question Card Transcriptions

Mind Map Photographs

Planet Play Questions

Planet Play Prototype and Display

CV

ETHICS APPLICATION

FORM

DOCUMENTATION

Information Letter for Parents

Consent Letter for Parents

Assent Letter for Child Participants

Protocol 1

Protocol 2

Workshop 1:

Question Card Questions

Mind Map Questions [Phase 1B]

Game Feedback Questions [Phase 1D]

Workshop 2:

Game Feedback Questions [Phase 2B]

Date: Fri Apr 20 16:35:00 2012

{ Print } Close

ID:Pro00026159**Status:**Changes Required by Supervisor

1.1 Study Identification

All questions preceded by a *red asterisk* * are required fields. However, answering only the required fields may not provide sufficient information for the REB in order to evaluate your application

Please answer all presented questions that will reasonably help to describe your study or proposed research

- 1.0 * **Short Study Title** (restricted to 250 characters):
Planet Play: Designing a game for children to promote environmental awareness
- 2.0 * **Complete Study Title** (can be exactly the same as short title):
Planet Play: Designing a game for children to promote environmental awareness
- 3.0 * **Select the appropriate Research Ethics Board** (Detailed descriptions are available by clicking the *HELP* link in the upper right hand corner of your screen):
REB 1
- 4.0 * **Is the proposed research:**
Unfunded
- 5.0 * **Name of Principal Investigator** (at the University of Alberta, Covenant Health, or Alberta Health Services):
Maria Goncharova
- 6.0 **Investigator's Supervisor** (required for applications from undergraduate students, graduate students, post-doctoral fellows and medical residents to Boards 1, 2, 3. HREB does not accept applications from student PIs)
Bonnie Sadler Takach
- 7.0 * **Type of research/study:**
Graduate Student - Thesis, Dissertation, Capping Project
- 8.0 **Study Coordinators or Research Assistants:** People listed here can edit this application and will receive all HERO notifications for the study:

Name	Employer
There are no items to display	
- 9.0 **Co-Investigators:** People listed here can edit this application but do not receive HERO notifications unless they are added to the study email list:

Name	Employer
There are no items to display	
- 10.0 **Study Team** (Co-investigators, supervising team, other study team members). People listed here cannot edit this application and do not receive HERO notifications

Last Name	First Name	Organization	Role	Phone	Email
There are no items to display					

1.5 Conflict of Interest

- 1.0 * **Are any of the investigators or their immediate family receiving any personal remuneration** (including investigator payments and recruitment incentives but excluding trainee

remuneration or graduate student stipends) from the funding of this study that is not accounted for in the study budget?

☐ Yes ☒ No

If YES, explain:

2.0 * Do any of investigators or their immediate family have any proprietary interests in the product under study or the outcome of the research including patents, trademarks, copyrights, and licensing agreements?

☐ Yes ☒ No

3.0 Is there any compensation for this study that is affected by the study outcome?

☐ Yes ☒ No

4.0 Do any of the investigators or their immediate family have equity interest in the sponsoring company? (This does not include Mutual Funds)

☐ Yes ☒ No

5.0 Do any of the investigators or their immediate family receive payments of other sorts, from this sponsor (i.e. grants, compensation in the form of equipment or supplies, retainers for ongoing consultation and honoraria)?

☐ Yes ☒ No

6.0 Are any of the investigators or their immediate family, members of the sponsor's Board of Directors, Scientific Advisory Panel or comparable body?

☐ Yes ☒ No

7.0 Do you have any other relationship, financial or non-financial, that, if not disclosed, could be construed as a conflict of interest?

☐ Yes ☒ No

If YES, explain:

Important

If you answered YES to any of the questions above, you may be contacted by the REB for more information or asked to submit a Conflict of Interest Declaration

1.6 Research Locations and Other Approval

1.0 * List the locations of the proposed research, including recruitment activities. Provide name of institution or organization, town, or province as applicable (e.g. On campus, Alberta public elementary schools, shopping malls, doctors' offices in Lesser Slave Lake and Lac La Biche, AHS facilities in Zone 5, post-secondary students at UBC, UA, UT, McGill and Dalhousie, internet websites, etc.):

The proposed research will take place in an elementary school in Alberta, in a classroom during regularly scheduled class time. Schools outside Edmonton will be approached to ask for permission to perform the data collection testing. Information letters explaining the procedure, including benefits and potential risks will be distributed to parents via their child's homeroom teacher. Consent forms for parents will be attached to letters, assent forms will be given to children

2.0 * Indicate if the study will utilize or access facilities, programmes, resources, staff, students, specimens, patients or their records, at any of the sites affiliated with the following (select all that apply)

Not applicable

List all facilities or institutions as applicable:

3.0 * Indicate if the proposed research has or will receive ethics approval from other Research Ethics Board or institution. Choose all that apply:

Not Applicable

If OTHER, list the REB or Institution:

Name

There are no items to display

4.0 Does this study involve pandemic or similar emergency health research?

☐ Yes ☒ No

If YES, are you the lead investigator for this pandemic study?

☐ Yes ☒ No5.0 If this application is closely linked to research previously approved by one of the University of Alberta REBs or has already received ethics approval from an external ethics review board(s), provide the HERO study number, REB name or other identifying information. Attach any external REB application and approval letter in Section 7.1.11 – Other Documents.
Not applicable.

2.1 Study Objectives and Design

1.0 Date that you expect to start working with human participants:
5/25/20122.0 Date that you expect to finish working with human participants, in other words, you will no longer be in contact with the research participants, including data verification and reporting back to the group or community:
11/30/20123.0 * Provide a lay summary of your proposed research suitable for the general public (*restricted to 300 words*). If the PI is not affiliated with the University of Alberta, Alberta Health Services or Covenant Health, please include institutional affiliation.

The purpose of this research is to use design as a tool for creating a children's game to explore concepts, scenarios, and strategies of protecting and preserving the environment. The intent of the game is to support learning, interest, and willingness in children to take notions of environmental preservation beyond the classroom and to encourage and empower children to take action in protecting the planet and promoting environmentally responsible behavior in their future. The research process will involve qualitative assessment of the effectiveness of currently available environmental education games and the effectiveness of the game prototype designed by the researcher. The prototype will be developed based on the combination of a literature review, visual analysis of existing environmental education games, and two participatory workshops with children attending the fourth grade of elementary school. The overall findings will be used to develop guidelines for designing environmental games for children

4.0 * Provide a description of your research proposal including study objectives, background, scope, methods, procedures, etc) (*restricted to 1000 words*). Footnotes and references are not required and best not included here. Research methods questions in Section 5 will prompt additional questions and information.

Study Objectives:

Environmental education is crucial for current and future generations and children should be educated to understand environmental issues at an early age so they can contribute to environmentally responsible actions to bring about positive change. The focus of this study is on integrating research in design, child development and educational strategies with environmental issues, into the development of a game that supports [encourages] active learning or learning through play. A game exploring concepts, scenarios, and strategies of environmental preservation can encourage and empower children to become active participants in preserving the planet and promoting environmentally responsible behavior. Children attending elementary schools in Alberta begin to be taught basic ecological conservation issues in the fourth grade. They are educated through an inquiry-based curriculum that also promotes active learning. Playing a game where environmental issues are explored could assist children in solidifying the concepts they learn in class, as well as introduce them to an engaging new way of learning.

Background:

According to literature on child psychology and development, many children learn best through play, as they can engage actively with information. The process of playing an educational game supports the understanding of new ideas and theories, in addition to conventional classroom-based

methods of instruction. Information acquisition and anticipated retention can be significantly improved if the learning approach is dynamic and enjoyable. The selected age group of participants falls into the category of Concrete Operational stage of cognitive development in children, as proposed by Piaget. These child participants will pertain to the latest phase of the Concrete Operations, transitioning into the Formal Operational stage of development. The participants should have begun forming adult logic patterns, allowing them to rationalize concrete, real-life situations, as well as classify objects as belonging to two or more categories simultaneously. This basic amount of classification and rationalization skills at this stage of development will allow participants to contribute their opinions and suggestions to the design process of a visual tool, such as a game.

Scope:

The scope of this exploratory project is the design and testing of a game intended to support children's learning, interest, and willingness to take notions of environmental preservation beyond the classroom. A conceptual visual prototype of this game will be developed based on the combination of a literature review, visual analysis of existing environmental education games, and two participatory workshops with children attending the fourth grade of elementary school. The environmental aspect of the game will not be negative or overwhelming – participants will learn about possible solutions and positive contributions they could undertake to reduce environmental problems and become aware of environmentally conscious behavior. The research study will be based on the Alberta Education Curriculum developed for students attending the fourth grade. The data collected is not expected to be representative of any other location or situation

Methods:

The methods of this study will facilitate the development of a game prototype, as described above. The design study will take place at an elementary school in Alberta, during regularly scheduled time with 20 to 30 fourth grade students. Students will be divided into four groups, each group monitored by a session facilitator. Session facilitators will be other graduate students in the department of Art and Design at the University of Alberta. The teacher will supervise the class, being most familiar with the students, as the principal researcher oversees the process. Materials for this research study will be question cards, four existing environmental games, non-toxic brainstorming and prototype-making materials [including foam boards, color markers and color pens, notepads, glue, large sheets of paper] and an environmental education game prototype developed by the researcher.

Procedures

The research procedure will consist of two main phases with constituent sub-phases. The data collection is intended to take place on two separate occasions, with approximately two to eight weeks in between Phase 1 and Phase 2

Phase 1: [See Documentation]

A: Environmental Awareness 1 – Question Cards [20 minutes]

The researcher will introduce herself and four session facilitators to the students. She will briefly discuss general concepts of environmental preservation, reminding the students of the material included in their school curriculum. Session facilitators will subsequently invite the students to separate into small groups of two [and three if there is an odd number of students], asking them to informally interview each other about environmental issues. The researcher will provide each student with cards containing basic environmental questions to initiate the interview process. The cards will have two sides – one side with a question about the environment based on the school curriculum, and the other side blank for recording answers. Students will take turns questioning their partner and recording the answers on the back of the question cards.

B: Environmental Awareness 2 – Question Card Feedback [20 minutes]

Facilitators will invite students to separate into four groups – one group per facilitator. Each group will be provided with brainstorming materials [such as color markers and color pens, notepads and large sheets of paper]. The facilitator will then name an environmental issue and invite the children in their group to reflect upon this issue by asking guiding questions. Students will be asked to contribute opinions and knowledge about their environmental issue in the form of both verbal and visual associations. The facilitators will record the answers and feedback of the group members into graphic organizers, such as mind maps or flow charts. Prior to commencing the collection of feedback, the researcher and facilitators will briefly demonstrate to the class an example of recording information onto a graphic organizer

C: Playing Selected Games [30 minutes]

Session facilitators will distribute four different existing games to their groups. All four games will be environmental in nature, each focusing on a different type of play – a board game, open-ended question/answer, strategy, and role play/simulation. Games will be chosen based on the visual analysis of existing environmental games. Facilitators will explain the rules to their groups and then oversee the proceedings. The games will be played simultaneously, allowing students the possibility to experience four different types of game play. If some games last longer than others, they will be ended early, since the purpose of this phase is to give child participants exposure to various types of play

D: Playing Selected Games Feedback [20 minutes]

Facilitators will collect the games and once again provide the children in their group with brainstorming materials [such as color markers and color pens, notepads and large sheets of paper]. The facilitator will then invite the children to reflect upon the game they just played by asking guiding questions about the qualities of the game and the experience children had with it. Students will be asked to contribute opinions about the game in the form of both verbal and visual feedback. The facilitators will record the answers of the group members into graphic organizers, such as mind maps or flow charts.

The researcher will analyze the data gathered in Phase 1 to support the creating of an environmental game prototype, based on the experiences and feedback provided during the session. The game prototype will be tested in Phase 2

Phase 2: [See Documentation]

A: Game Prototype Testing [30 minutes]

The researcher will re-introduce herself and four session facilitators to the students. She will briefly remind the students of the activities they participated in during her previous visit. Session facilitators will invite the students to separate into four groups and will distribute the environmental game prototype. All groups will play variations of the same game, each with changing aspects of environmental awareness as well as different styles of game play [such as board game, open-ended question/answer, strategy, and role play/simulation]. The specifications for designing the game will be determined based on the data gathered in Phase 1, as well as the literature review and visual analysis of existing environmental games.

B: Game Prototype Feedback [30 minutes]

Facilitators will collect the games and provide the children in their group with brainstorming and prototype making materials [such as foam boards, color markers and color pens, notepads, glue, large sheets of paper]. The facilitator will then invite the children to reflect upon the game they just played by asking guiding questions about the qualities of the game and the experience children had with it. Students will be asked to contribute opinions and suggestions about the game in the form of both verbal and visual feedback. The facilitators will record the answers of the group members into graphic organizers, such as mind maps or flow charts. Children will be asked to use prototype-making materials to express their suggestions creatively and physically, if they so desire.

The researcher will oversee and observe all sessions.

- 5.0 **Describe procedures, treatment, or activities that are above or in addition to standard practices in this study area** (eg. extra medical or health-related procedures, curriculum enhancements, extra follow-up, etc):
N/A
- 6.0 **If the proposed research is above minimal risk and is not funded via a competitive peer review grant or industry-sponsored clinical trial, the REB will require evidence of scientific review. Provide information about the review process and its results if appropriate.**
N/A
- 7.0 **For clinical research only, describe any sub-studies associated with this application.**
N/A

3.1 Risk Assessment

- 1.0 *** Provide your assessment of the risks that may be associated with this research:**
Minimal Risk - research in which the probability and magnitude of possible harms implied by participation is no greater than those encountered by participants in those aspects of their everyday life that relate to the research (TCPS2)
- 2.0 *** Select all that might apply:**
Description of Potential Physical Risks and Discomforts
No Participants might feel physical fatigue, e.g. sleep deprivation
No Participants might feel physical stress, e.g. cardiovascular stress tests

- No Participants might sustain injury, infection, and intervention side-effects or complications
- No The physical risks will be greater than those encountered by the participants in everyday life

Potential Psychological, Emotional, Social and Other Risks and Discomforts

- No Participants might feel psychologically or emotionally stressed, demeaned, embarrassed, worried, anxious, scared or distressed, e.g. description of painful or traumatic events
- Possibly Participants might feel psychological or mental fatigue, e.g. intense concentration required
- Possibly Participants might experience cultural or social risk, e.g. loss of privacy or status or damage to reputation
- No Participants might be exposed to economic or legal risk, for instance non-anonymized workplace surveys
- No The risks will be greater than those encountered by the participants in everyday life

- 3.0 *** Provide details of the risks and discomforts associated with the research, for instance, health cognitive or emotional factors, socio-economic status or physiological or health conditions:**
Participants might feel psychological or mental fatigue, as well as possibly experience cultural or social risk throughout the workshops, however all of those are also possible for them to experience in everyday activities at school or at home. Overall, the risk associated with participation in this study is considered minimal and no greater than experienced in everyday activities.
- 4.0 *** Describe how you will manage and minimize risks and discomforts, as well as mitigate harm:**
The risk to children participating in this study is minimal and is no greater than might be experienced within a regular school-based class. To ensure that there is minimal risk to human participants involved in the data collection process of the research study, the researcher will
1. Prior to commencing the data collection portion of the research study, become familiar with the ethical considerations of working with human participants by reading and understanding Section 66 of the GFC Policy Manual
 2. Meet with research facilitators and make sure they are familiar with the ethical considerations of working with human participants, have read and understood Section 66 of the GFC Policy Manual.
 3. Brief the facilitators on the data collection procedure making sure they clearly understand their role in the process
 4. Clearly communicate the nature of the research study to the participants, explaining what is being asked of them and the risks and benefits of being involved in the study
 5. Respect the dignity of any persons participating in the research study.
 5. Conduct the research study in an ethical and appropriate way, considering the comfort level of the participants, and where possible preserving the anonymity of participants through proper data collection, storage and disposal methods

The teacher in charge of the class during which the study takes place will be present for the time of the activities. He/she will monitor the proceedings, ensuring that all children are at ease. If participants choose to withdraw from the study at any time, the teacher will provide them with alternate activities. Participants will be fully informed of the purpose of the project and will be encouraged to ask questions regarding the project. Children's participation in this study is voluntary under the agreement of their parent/guardian. Children can refuse to participate in the study and can withdraw at any time without any consequence

All collected data related to child participants will be anonymous and/or a part of anonymous group results

- 5.0 *** If your study has the potential to identify individuals that are upset, distressed, or disturbed, or individuals warranting medical attention, describe the arrangements made to try to assist these individuals. Explain if no arrangements have been made:**
There are no known risks associated with this study. It is unlikely that children participating in the study will encounter distress, or will be disturbed or upset by the proceedings. There may be risks to being in this study that are not known. If the researcher or their supervisor learn of anything during the research that may affect the participants of the study, they will inform the

parents/guardians and school staff. If a child participant exhibits discomfort during this study, the parents/guardians will be notified immediately. The assistance of a school counselor employed at the school will be requested and the child participant will be invited to meet with them.

3.2 Benefits Analysis

- 1.0 * **Describe any potential benefits of the proposed research to the participants. If there are no benefits, state this explicitly:**
SHORT TERM BENEFITS
 The proposed research will benefit child participants by helping them become familiar with environmental issues, ways of preserving the environment and overall respectful treatment of the planet and its resources. The research sessions will also assist children in solidifying the environmental concepts they learn in class, which are included into their school curriculum. The sessions will introduce child participants to an engaging way of information processing, such as brainstorming and idea sharing facilitated by graphic organizers, which assemble information chains based on verbal and visual associative thinking.
- LONG TERM BENEFITS**
 The outcome of the proposed research will aid in encouraging and empowering children to become active participants in preserving the planet and promoting environmentally responsible behavior in the future
- 2.0 * **Describe the scientific and/or scholarly benefits of the proposed research:**
 Designing a game exploring concepts, scenarios, and strategies of environmental preservation based on the feedback of the children participating in this research study can inform designers, design scholars, and educational researchers. The data collected and prototype created in the process of the proposed research study will add to the body of existing knowledge in the fields of child development, game design, and active learning
- The data gathered during the study can promote further collaboration between game design researchers and school curriculum developers, encouraging the spread of environmental awareness both within and outside of educational facilities. The proposed research will provide an understanding of children's preferences in the field of games and playing as well as the potential design of an environmental game.
- The proposed research is intended to support learning, interest, and willingness in children to take notions of environmental preservation beyond the classroom. An environmentally educational game that is proposed by the researcher would assist children in solidifying the concepts they learn in class, as well as introduce them to engaging ways of gaining vital knowledge. Its scholarly benefits intend to encourage and empower children to become active participants both locally in their communities and globally, by preserving the planet and promoting environmentally responsible behavior.
- 3.0 **Benefits/Risks Analysis: Describe the relationship of benefits to risk of participation in the research:**
 As outlined above, the benefits to the participants in this study will far outweigh the possible minimal risks involved

4.1 Participant Information

- 1.0 * **Who are you studying? Describe the population that will be included in this study.**
 Participants for this research are 20-30 fourth grade students aged 9-11 years attending an elementary school in Alberta. The design of the game will be evaluated rather than the performance of the participants
- 2.0 * **Describe the inclusion criteria for participants (e.g. age range, health status, gender, etc.). Justify the inclusion criteria (e.g. safety, uniformity, research methodology, statistical requirement, etc)**
 This is an inclusive study where all child participants including participants with special needs can be accommodated. No child would be excluded on the basis of his/her abilities
- Participants for this research are 20-30 fourth grade students, between 9 and 11 years of age, depending on their initial age of entering primary school. The selected age group falls into the category of Concrete Operational stage of cognitive development in children, as discussed by Jean Piaget. The child participants in question will pertain to the latest phase of the Concrete Operations, transitioning into the Formal Operational stage of development. The child participants should have begun forming adult logic patterns, allowing them to rationalize concrete, real-life

situations, as well as classify objects as belonging to two or more categories simultaneously. This basic amount of classification and rationalization skills from participants is enough to partake in the design process of a visual tool, such as a game.

Other participants in this research study are 4 session facilitators who are graduate students in the department of Art and Design at the University of Alberta

3.0 **Describe and justify the exclusion criteria for participants:**

The research methods are designed for grade 4 students as described above.

4.0 **' Will you be interacting with human subjects, will there be direct contact with human participants, for this study?**

☒ Yes ☐ No

Note: No means no direct contact with participants, chart reviews, secondary data, interaction, etc.

If NO, is this project a chart review or is a chart review part of this research project?

☐ Yes ☒ No

5.0 **Participants**

How many participants do you hope to recruit (including controls, if applicable)

25

Of these how many are controls, if applicable (Possible answer: Half, Random, Unknown, or an estimate in numbers, etc)

None

If this is a multi-site study, for instance a clinical trial, how many participants (including controls, if applicable) are expected to be enrolled by all investigators at all sites in the entire study?

0

6.0 **Justification for sample size:**

This study is exploratory and related to designing a game for children. It requires the sample size of participants to be calculated based on approximating a generally expected average-size class, which falls between 20 and 30 students. It does not require the evaluation of individual participants or their performance, but rather aims to collect their opinions and feedback on the design of an environmental game prototype. The students participating in this research study will all be part of an established class and it is likely they will be used to working together prior to the arrival of the researcher and commencement of the data collection.

7.0 **Does the research specifically target aboriginal groups or communities?**

☐ Yes ☒ No

4.3 Recruit Potential Participants

1.0 **Recruitment**

1.1 How will potential participants be identified? Outline how you will identify the people who will be approached for participation or screened for eligibility.

Potential participants will be identified through their enrollment in the fourth grade of an elementary school in Alberta. The participants will not be approached by the researcher personally. The school will be approached by the researcher prior to the commencement of the data collection phases of this research study. Participants will receive recruitment materials in the form of consent and information letters for their parents and assent letters for themselves from either their homeroom teacher or the teacher running the class during which data collection will take place

1.2 How will people obtain details about the research in order to make a decision about participating? Select all that apply:

Contact will be made through an third party or intermediary (including snowball sampling)

1.3 If appropriate, provide the locations where recruitment will occur (e.g schools, shopping malls, clinics, etc.)

Recruitment for both phases of data collection will occur in the elementary school which is selected for this research study. Recruitment will be approved by the superintendent of the selected school.

2.0 Pre-Existing Relationships

2.1 Will potential participants be recruited through pre-existing relationships with researchers (e.g. Will an instructor recruit students from his classes, or a physician recruit patients from her practice? Other examples may be employees, acquaintances, own children or family members, etc)?

☐ Yes ☒ No

2.2 If YES, identify the relationship between the researchers and participants that could compromise the freedom to decline (e.g. professor-student). **How will you ensure that there is no undue pressure on the potential participants to agree to the study?**
Not Applicable

3.0 Outline any other means by which participants could be identified, should additional participants be needed (e.g. response to advertising such as flyers, posters, ads in newspapers, websites, email, listservs; pre-existing records or existing registries; physician or community organization referrals; longitudinal study, etc)
If additional participants are needed, the same recruitment procedures will be followed

4.0 Will your study involve any of the following (select all that apply)?
None of the above

4.4 Third Party or Intermediary Contact Methods

1.0 If contact will be made through an intermediary (including snowball sampling), **select one of the following:**
Intermediary provides information to potential participants who then contact the researchers

2.0 Explain why the intermediary is appropriate and describe what steps will be taken to ensure participation is voluntary:
The intermediary for this research study will be a teacher of the fourth grade class participating in this research. The teacher is appropriate for being an intermediary for this research study because of his/her established relationship with the potential participants. The teacher will be invited to briefly explain to his/her class that a researcher will come by their class with some activities for the students to participate in. The intermediary will then distribute recruitment materials such as letters of Information, Assent, and Consent [See Documentation] for both the participants and their parents/guardians to sign.
The teacher's agreement for the research to be done during class time will signify agreement to participate. If the teacher refuses to allow this research study to take place during their class time, they will be asked to suggest another teacher to act as an intermediary.

4.5 Informed Consent Determination

1.0 Describe who will provide informed consent for this study (select all that apply).
Additional information on the informed consent process is available at:
<http://www.pre.ethics.gc.ca/eng/policy-politique/initiatives/tcps2-eptc2/chapter3-chapitre3/#toc03-intro>
Not all participants will have capacity to give free and informed consent (e.g. children, individuals with cognitive impairments, etc)

Provide justification for requesting a Waiver of Consent (Minimal risk only, additional guidance available at: <http://www.pre.ethics.gc.ca/eng/policy-politique/initiatives/tcps2-eptc2/chapter3-chapitre3/#toc03-1b>
Although the risk to participants is minimal, all parents/guardians of participants will be requested to complete a consent form. Because child participants are all under the age of 18 and cannot provide their own consent, they will be asked to provide their own assent by completing an assent form

2.0 How is participant consent to be indicated and documented? Select all that apply:
Signed consent form
Assent (usually seen in conjunction with another consent process, most often a signed consent form)

Except for "Signed consent form" use only, explain how the study information will be communicated and participant consent will be documented. Provide details for EACH of the option selected above:

[See Documentation]

Signed Consent: Participants under the age of 18 cannot provide their own consent and will be asked to provide consent forms signed by their parent/guardian. The research study will be outlined in the consent forms.

Assent: Participants under the age of 18 will be invited to give their assent for the data collection sessions in conjunction with signed consent forms from their parent/guardian. The research study will be outlined in the assent forms.

Participation is completely voluntary and participants may choose to withdraw from the study at any time, despite providing written and oral consent as well as assent.

3.0 Authorized Representative, Third Party Consent, Assent

3.1 Explain why participants lack capacity to give informed consent (e.g. age, mental or physical condition, etc.).

Participants under the age of 18 cannot provide their own consent.

3.2 Will participants who lack capacity to give full informed consent be asked to give assent?

☒ Yes ☐ No

Provide details. IF applicable, attach a copy of assent form(s) in the Documentation section.

[See Documentation]

Because this research study aims to empower children, child participants will be invited to give their assent for the data collection sessions. The research study will be outlined in the assent forms

3.3 In cases where participants (re)gain capacity to give informed consent during the study, how will they be asked to provide consent on their own behalf?

Not Applicable

4.0 What assistance will be provided to participants, or those consenting on their behalf, who have special needs? (E.g. non-English speakers, visually impaired, etc):

Participants will be provided with the researcher, session facilitators, teacher of the class, and school counselor who will be able to assist any participant if they require special assistance

5.0 * If at any time a participant wishes to withdraw, end, or modify their participation in the research or certain aspects of the research, describe how their participation would be ended or changed.

Participation is completely voluntary and participants may choose to withdraw from the study at any time, despite providing their parent/guardian's written consent as well as their own assent. To end or modify their participation in the research, participants will inform the class teacher, session facilitator or researcher of their decision. The teacher of the class will assist participants who no longer wish to participate in the research study, by providing them with alternative activities.

6.0 Describe the circumstances and limitations of data withdrawal from the study, including the last point at which it can be done:

Data created by the participants will be in the form of drawings and words. Children may request to withdraw from the study at anytime. To do so, they may notify the class teacher, session facilitator or researcher of their decision. Because this study is anonymous, it may be difficult to identify and extract a single participant's data, if participants make request for their input to be returned to them. Nonetheless, all efforts will be made to accommodate such requests.

7.0 Will this study involve any group(s) where non-participants are present? For example, classroom research might involve groups which include participants and non-participants.

☐ Yes ☒ No

5.1 Research Methods and Procedures

Some research methods prompt specific ethic issues. The methods listed below have additional questions associated with them in this application. If your research does not involve any of the methods listed below, ensure that your proposed research is adequately described in Section 2.0 Study Objectives and Design or attach documents in Section 7.0 if necessary

1.0 * This study will involve the following (select all that apply)

The list only includes categories that trigger additional page(s) for an online application. For any

other methods or procedures, please indicate and describe in your research proposal in the Study Summary, or provide in an attachment:

Sound or Image Data (other than audio or video-recorded interviews)

Materials created by participants (eg. artwork, writing samples, etc)

- 2.0 *** Is this study a Clinical trial? (Any investigation involving participants that evaluates the effects of one or more health-related interventions on health outcomes?)**
☐ Yes ☒ No
- 3.0 **If you are using any tests in this study diagnostically, indicate the member(s) of the study team who will administer the measures/instruments:**

Test Name	Test Administrator	Organization	Administrator's Qualification
There are no items to display			
- 4.0 **If any test results could be interpreted diagnostically, how will these be reported back to the participants?**
 Not Applicable

5.6 Sound or Image (other than audio- or video-recorded interviews) or Material Created by Participants

- 1.0 **Explain if consent obtained at the beginning of the study will be sufficient, or if it will be necessary to obtain consent at different times, for different stages of the study, or for different types of data:**
 Participants will be asked to provide consent forms signed by their parent/guardian prior to the collection of data both for Phase 1 and Phase 2. The research study will be outlined in the consent forms [see Documentation, Letter of Consent].
- 2.0 **At what stage, if any, can a participant withdraw his/her material?**
 Participation in this study is voluntary under the agreement of the child's parent/guardian. Children can refuse to participate in the study and can withdraw at any time without any consequence. To withdraw from the study, participants may notify the class teacher, session facilitator or researcher of their decision. Data created by the participants will be in the form of drawings and words. Because this study is anonymous, it may be difficult to identify and extract a specific participant's data. Nonetheless, all efforts will be made to accommodate the participant's requests to withdraw his/her material from the study.
- 3.0 **If you or your participant's audio- or video-records, photographs, or other materials artistically represent participants or others, what steps will you take to protect the dignity of those that may be represented or identified?**
 Still camera photography and video recording will be used by the researcher during the data collection phases. Video recordings will not be made public and will be collected for analyzing the experience and as a backup of written notes. The Consent and Assent forms outline that the participants' photos may be used for the Master of Design Thesis Project exhibition, presentations and in written articles [see Documentation]. Should the researcher quote any of the contributions or comments, pseudonyms will be used to grant anonymity to the participant.
- 4.0 **Who will have access to this data? For example, in cases where you will be sharing sounds, images, or materials for verification or feedback, what steps will you take to protect the dignity of those who may be represented or identified?**
 Still images will be used for the Master of Design Thesis Project exhibition, presentations and in written articles. The researcher and her supervisor will have access to the material collected during the research study, including the photographic and video material that will be used for analyzing the experience and as a backup of written notes. Should the researcher quote any of the contributions or comments, pseudonyms will be used to grant anonymity to the participant. Data will be kept in a secure place for a minimum of 5 years following completion of the research project, electronic data will be password protected
- 5.0 **When publicly reporting data or disseminating results of your study (eg presentation, reports, articles, books, curriculum material, performances, etc) that include the sounds, images, or materials created by participants you have collected, what steps will you take to protect the dignity of those who may be represented or identified?**
 Still images will be used for the Master of Design Thesis Project exhibition, presentations and in written articles. The video material will serve to analyze the experience and as a backup of written notes and will therefore not be disseminated. Should the researcher choose to quote any of the contributions or comments of the participants, pseudonyms will be used to grant anonymity to the participants. Data created by participants will be in the form of drawings and words on cards and

mind maps; participants will not be identified by name, should the data they created be used for the Master of Design Thesis Project exhibition, presentations and in written articles.

- 6.0 **What opportunities are provided to participants to choose to be identified as the author/creator of the materials created in situations where it makes sense to do so?**
This researcher does not intend to identify participants with their created materials. All data will be anonymous and part of group results. Participants who choose to be identified as the author/creator of the materials made during the data collection sessions, may do so, however, this decision will not change the status of their material or make it identifiable to the researcher or others involved in this research study.
- 7.0 **If necessary, what arrangements will you make to return original materials to participants?**
Data created by participants will be in the form of drawings and words on cards and mind maps, which are going to be identifiable only by the creator of the data. If participants request the return of their contributions, all efforts will be made to accommodate that request upon the completion of the Master of Design Thesis Project, however it might not be possible to identify the fragmented material at that time.

6.1 Data Collection

- 1.0 **Will the researcher or study team be able to identify any of the participants at any stage of the study?**
☒ Yes ☐ No
- 2.0 **Will participants be recruited or their data be collected from Alberta Health Services or Covenant Health or data custodian as defined in the Alberta Health Information Act?**
☐ Yes ☒ No
- Important:** Research involving health information must be reviewed by the Health Research Ethics Board
- 3.0 **Primary/raw data collected will be (check all that apply):**
All personal identifying information removed (anonymized)
- 4.0 **If this study involves secondary use of data, list all original sources:**
Not Applicable
- 5.0 **In research where total anonymity and confidentiality is sought but cannot be guaranteed (eg. where participants talk in a group) how will confidentiality be achieved?**
Photographs depicting the participant [hands and/or face and/or back] may be shown at the Master of Design Thesis Project exhibition, public presentations and in written articles with permission from participants through Consent and Assent forms. Participants will not be identified by name. Participants will be interacting with each other in groups, so should the researcher quote any of the contributions or comments, pseudonyms will be used to grant anonymity to all participants. Facilitators involved in this research study will be briefed prior to commencing the workshops and consequently asked to keep the discussions that take place confidential.

6.2 Data Identifiers

- 1.0 **Personal Identifiers:** will you be collecting - at any time during the study, including recruitment - any of the following (check all that apply):
Other
- If OTHER, please describe:**
Signatures from parents/guardians and well as participants will be required to be on completed Consent and Assent forms [see Documentation].
- 2.0 **Will you be collecting - at any time of the study, including recruitment of participants - any of the following (check all that apply):**
There are no items to display
- If OTHER, please describe:**
Not Applicable

- 3.0 * If you are collecting any of the above, provide a comprehensive rationale to explain why it is necessary to collect this information:
Not Applicable
- 4.0 If identifying information will be removed at some point, when and how will this be done?
Identifying information will not be added to any material.
- 5.0 * Specify what identifiable information will be **RETAINED** once data collection is complete, and explain why retention is necessary. Include the retention of master lists that link participant identifiers with de-identified data:
All contribution made by participants during the course of the data collection sessions will remain anonymous unless.
- 6.0 If applicable, describe your plans to link the data in this study with data associated with other studies (e.g within a data repository) or with data belonging to another organization:
Not Applicable

6.3 Data Confidentiality and Privacy

- 1.0 * How will confidentiality of the data be maintained? Describe how the identity of participants will be protected both during and after research.
All collected data related to child participants will be anonymous and/or a part of anonymous group results. After the data collection phases have been completed, the confidentiality of data will be maintained by coding the data, such as photographs
- 2.0 How will the principal investigator ensure that all study personnel are aware of their responsibilities concerning participants' privacy and the confidentiality of their information?
Research study facilitators will all be graduate students and/or instructors at the Department of Art&Design at University of Alberta. They will be briefed by the researcher and familiarized with Ethics regulations concerning involvement of Human Participants prior to initiating the research study. Research facilitators will be asked to keep all discussions that take place during the workshops confidential
- 3.0 External Data Access
- * 3.1 Will identifiable data be transferred or made available to persons or agencies outside the research team?
☐ Yes ☒ No
- 3.2 If YES, describe in detail what identifiable information will be released, to whom, why they need access, and under what conditions? What safeguards will be used to protect the identity of subjects and the privacy of their data.
N/A
- 3.3 Provide details if identifiable data will be leaving the institution, province, or country (eg. member of research team is located in another institution or country, etc.)
N/A

6.4 Data Storage, Retention, and Disposal

- 1.0 * Describe how research data will be stored, e.g. digital files, hard copies, audio recordings, other. Specify the physical location and how it will be secured to protect confidentiality and privacy. (For example, study documents must be kept in a locked filing cabinet and computer files are encrypted, etc.)
Digital files [photographs and video recordings] will be collected and stored on an external hard drive available to the researcher and her supervisor only. The hard drive will be protected by a password that will only be available to the principal researcher and her supervisor
- 2.0 * University policy requires that you keep your data for a minimum of 5 years following completion of the study but there is no limit on data retention. Specify any plans for future use of the data. If the data will become part of a data repository or if this study involves the creation of a research database or registry for future research use, please provide details.
In the near future data will be used for the Master of Design thesis exhibit, report and in research articles. Data will be destroyed after 5 years

- 3.0 If you plan to destroy your data, describe when and how this will be done? Indicate your plans for the destruction of the identifiers at the earliest opportunity consistent with the conduct of the research and/or clinical needs:
Digital files will be securely erased after 5 years, along with the rest of the collected data

7.1 Documentation

Add documents in this section according to the headers. Use Item 11.0 "Other Documents" for any material not specifically mentioned below.

Sample templates are available in the HERO Home Page in the [Forms and Templates](#), or by clicking [HERE](#)

- 1.0 **Recruitment Materials:**
- | Document Name | Version | Date | Description |
|-------------------------------|---------|------|-------------|
| There are no items to display | | | |
- 2.0 **Letter of Initial Contact:**
- | Document Name | Version | Date | Description |
|-----------------------------------|---------|---------------------|-------------|
| INFORMATION LETTER.docx History | 0.01 | 12/16/2011 10:39 AM | |
- 3.0 **Informed Consent / Information Document(s):**
- 3.1 What is the reading level of the Informed Consent Form(s):
- 3.2 Informed Consent Form(s)/Information Document(s):
- | Document Name | Version | Date | Description |
|--|---------|---------------------|-------------|
| CONSENT FORM for PARENT.docx History | 0.01 | 12/16/2011 10:40 AM | |
- 4.0 **Assent Forms:**
- | Document Name | Version | Date | Description |
|--|---------|---------------------|-------------|
| ASSENT FORM for CHILD PARTICIPANT.docx History | 0.01 | 12/16/2011 11:17 AM | |
- 5.0 **Questionnaires, Cover Letters, Surveys, Tests, Interview Scripts, etc.:**
- | Document Name | Version | Date | Description |
|-------------------------------|---------|------|-------------|
| There are no items to display | | | |
- 6.0 **Protocol:**
- | Document Name | Version | Date | Description |
|--------------------------|---------|---------------------|-------------|
| PROTOCOL1.docx History | 0.01 | 12/16/2011 11:33 AM | |
| PROTOCOL2.docx History | 0.01 | 12/16/2011 11:33 AM | |
- 7.0 **Investigator Brochures/Product Monographs (Clinical Applications only):**
- | Document Name | Version | Date | Description |
|-------------------------------|---------|------|-------------|
| There are no items to display | | | |
- 8.0 **Health Canada No Objection Letter (NOL):**
- | Document Name | Version | Date | Description |
|-------------------------------|---------|------|-------------|
| There are no items to display | | | |
- 9.0 **Confidentiality Agreement:**
- | Document Name | Version | Date | Description |
|-------------------------------|---------|------|-------------|
| There are no items to display | | | |
- 10.0 **Conflict of Interest:**
- | Document Name | Version | Date | Description |
|-------------------------------|---------|------|-------------|
| There are no items to display | | | |
- 11.0 **Other Documents:**
For example, Study Budget, Course Outline, or other documents not mentioned above
- | Document Name | Version | Date | Description |
|-------------------------------|---------|------|-------------|
| There are no items to display | | | |

INFORMATION LETTER for PARENT/GUARDIAN

Planet Play: Designing a game for children to promote environmental awareness.

Dear Parent or Guardian,

I would like to ask your permission to allow your child to participate in a study that will explore the development of a children's game to promote environmental awareness. Your child's involvement in and contribution to the design process is necessary for creating a game prototype that appeals to the needs and wants of children. The participation of your child would be to give feedback on existing environmental games as well as a mock-up of a new game that promotes environmental awareness. This study does not in any way test the ability and/or performance of your child, but focuses on exploring already existing environmental games and their performance. The study will be conducted as part of the Master of Design Thesis Project, Department of Art and Design at the University of Alberta.

Purpose

The purpose of this project is to design an environmental education game that will explore concepts, scenarios, and strategies for protecting and preserving the environment. This game's intent is to support learning, interest, and willingness in children to take notions of environmental preservation beyond the classroom.

Study Procedures

The study will involve two phases and children are invited to participate in any of the phases that are of interest to them:

Phase 1:

A. Environmental Awareness 1 – Question Cards [Duration: 20 minutes]

I will introduce myself and four session facilitators to the students. I will briefly discuss general concepts of environmental preservation, reminding the students of the material included in their school curriculum. Facilitators will then separate the students into small groups, asking them to informally interview each other about environmental issues. I will provide question cards to initiate the interview process. The cards will have a question side, asking about the environment based on the school curriculum, as well as a blank side for recording answers.

B. Environmental Awareness 2 – Question Card Feedback [Duration: 20 minutes]

Students will be organized into four groups – one group per session facilitator. Each group will be invited to give feedback and share ideas about an environmental issue described to them by the group leader [facilitator]. Facilitators will ask guiding questions and record the answers and feedback into graphic organizers [mind maps or flow charts]. The students will be asked to offer their feedback about environmental issues in the form of verbal and visual associations. My research facilitators and I will briefly demonstrate an example of a graphic organizer prior to beginning the collection of feedback from the groups.

C. Playing Selected Games [Duration: 30 minutes]

Four different existing environmental games will be given to students – one game per group. The games will occur simultaneously, allowing the class the possibility to experience four different types of game play.

D. Game Feedback & Brainstorming [Duration: 20 minutes]

Students will be invited to give feedback in the form of opinions about the games they played. Facilitators will ask guiding questions and record the answers and feedback into graphic organizers, as I oversee the sessions.

I will analyze the data gathered in Phase 1 in order to create a prototype of an environmental game, based on the experiences and feedback provided by the children during the sessions. The game prototype will be tested in Phase 2.

Phase 2:

A. Game Prototype Testing [Duration: 30 minutes]

Facilitators will distribute the environmental game prototype to their groups. All groups will play variations of the same game, each with differing aspects of environmental awareness as well as different styles of game play [such as board game, open-ended question/answer, strategy, and role play/simulation].

B. Game Prototype Feedback [Duration: 30 minutes]

Facilitators will invite students to give feedback in the form of opinions about the games they played, asking guiding questions and recording the answers and feedback into graphic organizers. I will oversee and observe the sessions.

Benefits

The proposed research will benefit child participants by helping them become familiar with environmental issues, ways of preserving the environment and overall respectful treatment of the planet and its resources. Additionally, the information gathered in this study can provide a greater understanding of environmental issues that are currently included in your child's school curriculum. The sessions will also introduce child participants to an engaging way of information processing, such as brainstorming and idea sharing facilitated by graphic organizers, which assemble information chains based on verbal and visual associative thinking. The outcome of the proposed research will aid in encouraging and empowering children to become active participants in preserving the planet and promoting environmentally responsible behavior in the future. There are no costs involved to participants in this research.

Risk

The risks of participating in this study are minimal and no greater than experienced in everyday activities at school. Although unlikely, there may be risks to being in this study that are not known. If I learn of anything during the research that may affect willingness to allow your child to continue being in the study, I will inform you right away.

Voluntary Participation

Your child is under no obligation to participate in this study. The participation is completely voluntary. Even if you agree for your child to be in the study, you and/or your child can change your minds and withdraw at any time. If you agree for your child to participate in this study, please provide the attached Assent Letter to your child to read and fill out. Please review the assent letter with your child and if your child wishes to participate in this study, they can agree to do so by signing the Assent Letter and then bringing it back to class with them. If your child does not wish to participate or wants to withdraw from the study at any time, the teacher of the class will provide alternate activities for them.

Confidentiality & Anonymity

Data created by your child will be in the form of drawings and words on cards and mind maps. If you or your child request the return of his/her contribution, all efforts will be made to accommodate that request upon the completion of the Master of Design Thesis Project. Still camera photography of your child [hands and/or face and/or back] will be used by the researcher during the data collection phases. These photographs may be

shown at the Master of Design Thesis Project exhibition, public presentations and in written articles. Video recordings of the proceedings will be used as well. None of the video recordings will be made public and will be used only for the purpose of analyzing the experience and as a backup of written notes. Your child will never be identified by name. Should the researcher quote any of the contributions or comments, pseudonyms will be used to grant anonymity to the participants. Data will be kept in a secure place for a minimum of 5 years following completion of the research project, electronic data will be encrypted. A written report will be made available to anyone who is interested in knowing about the research.

Further Information

The plan for this study has been reviewed for its adherence to ethical guidelines by a Research Ethics Board at the University of Alberta. For questions regarding participant rights and ethical conduct of research, contact the Research Ethics Office at 780 492 2615.

Your cooperation in this project is highly appreciated. If you agree to have your child participate, please sign the attached permission form and have your child return it to their homeroom teacher at your earliest convenience. Thank you very much for your time and consideration.

Sincerely,

Maria Goncharova

If you have any questions regarding this project, please contact:

Research Investigator
Maria Goncharova
Faculty of Arts
University of Alberta
Edmonton, AB, T6G2C9
goncharo@ualberta.ca
780 885 6820

Supervisor
Bonnie Sadler Takach
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University of Alberta
Edmonton, AB, T6G2C9
bbs@ualberta.ca
780 492 5092

May 1, 2011

CONSENT FORM for PARENT/GUARDIAN

Planet Play: Designing a game for children to promote environmental awareness.

I, _____, hereby consent

[print name of parent/guardian]

for _____

[print name of student]

to participate in the study concerning designing an environmental game, a research project lead by Maria Goncharova [Department of Art & Design, University of Alberta], which will be conducted as part of the Master of Design Thesis Project.

I understand that:

- ☐ The study will take place during class time.
- ☐ My child can withdraw from the study at any time without penalty.
- ☐ My child's actions may be recorded on video. The recordings will not be made public and will only be used for data analysis backup.
- ☐ Pictures that show my child [hands and/or face and/or back] may be shown at the Master of Design Thesis Project exhibition, public presentations and in written articles. My child will not be identified by name.
- ☐ Should the researcher quote any of the contributions or comments, pseudonyms will be used to grant anonymity to my child.
- ☐ All information will be treated confidentially and will be used to analyze the research process and experience.
- ☐ My child's data will be an anonymous part of group results.

I also understand that the results of this research will be used in the following:

- ☐ Written Master in Design Thesis
- ☐ Master in Design Thesis Project exhibition
- ☐ Public presentations and written articles that may be published

SIGNATURE

DATE

If you have any questions regarding this project, please contact:

Research Investigator

Maria Goncharova

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University of Alberta

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ASSENT FORM for CHILD PARTICIPANT

Planet Play: Designing a game for children to promote environmental awareness.

I want to tell you about the research study I am doing. A research study is a way to learn more about something. I am interested to find out more about designing a game that teaches children about our planet and how to protect it. You are being asked to be part of this study because your thoughts and ideas are very important to this research and you can help make the design of the game fun and enjoyable for other children.

If you agree to participate in this study, you will be asked to answer some questions from question cards about the environment and then play games in small groups. After playing games and answering some questions, I will invite you to share your thoughts on the questions and the games by brainstorming with your friends and recording your ideas into mind maps. This will only take two classes, one class soon and another one in a few weeks.

The activities proposed to you should not be difficult to do and you will not be graded for your participation. I couldn't imagine that you experience any discomfort connected to any of the activities.

This study will help me to learn more about game design and what makes a game fun for people your age. I expect that the study will also help you by letting you understand more about the environment and ways to protect it. During this study, I may learn something that will help other children to someday enjoy playing games and learning useful information at the same time.

You do not have to participate in this study. It is up to you. You can say okay now and change your mind later. All you have to do is tell us you want to stop. No one will be mad at you if you don't want to be in the study or if you join the study and change your mind later and want to stop.

If you join the study, you can ask questions at any time. Just tell the researcher that you have a question. I hope that this is going to be enjoyable for you!

- ☐ Yes, I'd like to participate in this research study.
- ☐ No, I don't want to participate in this research study.

NAME

SIGNATURE

DATE

If you have any questions regarding this project, please contact:

Research Investigator
Maria Goncharova
Faculty of Arts
University of Alberta
Edmonton, AB, T6G2C9
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PROTOCOL: PART 1

Planet Play: Designing a game for children to promote environmental awareness.

Hello everyone, my name is Maria. I am doing my graduate studies at the University of Alberta in Visual Communication Design. These are _____ [name of facilitator], _____ [name of facilitator], _____ [name of facilitator], and _____ [name of facilitator]. They are also all studying and working at the University of Alberta with me and will be helping both you and me with today's activities.

Today I am here to tell you about what I am working on and ask you to help me with it. I am designing a game. This game will help children like you to learn about the environment and how we can try to protect it for your children and their children and their children's children. Today you will play games and then share your ideas and thoughts about them with each other and with all of us by brainstorming in groups.

After our time together today is done, I will come back again soon and bring another game with me. This time it will be a game that I will design based on all the help that you give me today. Your thoughts and ideas are very important to me, because I would like to make my game as interesting and enjoyable for you as possible. And the only way I can do that is if you can help me to understand what you would want my game to be like. Your opinions and thoughts about what you like or don't like about the games that you will be playing today are also very important to me.

None of what you do today or the next time I come here is a test of your abilities. Everybody's opinions and ideas matter equally and are all a huge help to me, because they will make it clear what is working and what is not working with the games that you will be playing today. You will be able to help me design a better game that combines things you enjoy and avoids things you don't find fun.

I will also be taking some photos of you when you are playing the games and sharing your ideas by brainstorming. If you don't want to participate in the activities today, then I will not be taking your picture and you can just play or draw until the end of the activities. Maybe next time, when I come back with more games, you can decide you would like to participate. And please remember – there is no pressure at all, you are more than welcome to stay and watch what we are going to do. Can I see a show of hands now please? Put up your hand if you decided that you are going to participate.

[Children, who have decided to opt out, follow their teacher. The teacher involves them in an activity they see fit, such as playing another game, coloring, reading, drawing, etc. or they choose to stay and watch the rest of the proceedings.]

Phase 1

A. Environmental Awareness 1 – Question Cards [Duration: 20 minutes]

Materials: Two-sided environmental picture cards designed and provided by researcher based on existing material: Alberta Education school science curriculum for grade 4, existing environmental games and a literature review.

Lets begin our first activity by briefly talking about environmental stuff and why it is important to save our planet for the future generations. You already learnt in school a little about the environment and things you can do to help it last us all many lifetimes. You learnt about things that harm the environment like waste, and that it is “produced through natural processes and human technology”. Your teacher also told you about identifying waste “produced within [...] your community and [...] the methods used” for disposing of it, “that some waste materials are biodegradable, that some are reusable, and that others are toxic.” You learnt about recycling, that all “plants, animals and other living things are made up of materials that are recycled through the environment again and again.” You learnt about what helps the environment, “the importance of plants to humans and their importance to the natural environment.” That plants can be “used as a source of food or shelter” and play a big role in the environment, like “preventing erosion and maintaining oxygen.” Finally, you learnt what plants need to grow, like clean air, “light energy, water, nutrients and space,” as well as a proper temperature that is not too hot or cold and good levels of humidity, which are all at risk with climate change and global warming.

Now that we refreshed our memories about the environmental stuff that you already know, I would like you to pick a partner and sit together. You will be interviewing each other. Please pick a partner. If there is an odd number of people, you can form one group of three. *[Students pick partners and sit together. If there are an odd number of students, there will be one group of three.]* Are we all in groups? Now please take a few minutes to ask each other the questions on the back of the cards that my assistants will give you. *[Facilitators all distribute the cards. The cards are all shuffled to be different in color].* You each get 5 cards. Read the question on the back of the card to your partner and ask them to answer it with as many words as possible. See how the cards have two sides? Please write down your answers on the blank / back side of the cards. Your answers can be in different forms – you can draw pictures and write words, or just use colors, if you think that answers the question best in your opinion.

For example I will ask _____ *[name of facilitator]* a question from one of my 5 cards. *[Researcher reads question to facilitator, facilitator answers with basic words and descriptions, writing words and sketches of pictures and / or colors on the blank side of the question card.]* Now _____ *[name of facilitator]* will ask me a question from one of his/her cards and I will answer. *[Facilitator reads question to researcher, researcher answers with basic words and descriptions. Researcher writes the answer words and sketches pictures and/or colors on the blank side of the question card.]* I am definitely not a good artist! But that doesn't matter, because we are not looking for a perfect picture or a magic word, just some keywords and associations that first come to your mind when you ask each other the question. See how we are taking turns to ask and answer each other's questions?

Now I would like you to do the same with your partners.

[Students take turns asking and answering questions.]

Our time is up, if you still haven't finished answering all the questions, that's just fine. Because we will now get into small groups for the next activity. My assistants will now help me to collect the question cards from you, so I can take them with me to my university. I will analyze them and use your pictures and words to make a new game for you to play when I come back next time. *[Facilitators collect cards and hand them to researcher.]*

B. Environmental Awareness 2 – Question Card Feedback [Duration: 20 minutes]

Materials: Guiding questions / topics, brainstorming materials, including foam boards, non-toxic color markers and color pens, notepads, large sheets of paper.

So now I will ask you to form groups, so you can have a fun brainstorming session with my research assistants. There are lots of colors in nature, so each group will be a certain color. We have 4 groups, a red group, a yellow group, a blue group, and a green group. I will give you each a color now and that will be your group! *[Assign colors – yellow, red, blue, green to all participating students.]* Does everybody remember their color? Please follow your group leader *[facilitator with one of the four colors clearly visible]*.

I will now demonstrate what a brainstorming session is like with my assistants. *[Facilitators leave their groups and join researcher in demonstration.]* Ok, _____, _____, _____, and _____ *[names of facilitators]*, lets brainstorm together on the topic of energy and how we could conserve and save it in the most efficient ways as well as other things you can think of. I will make a mind map based on your answers! *[Using foam board and color markers, researcher writes and circles the word ENERGY in the center of the board with three branches leading to sub-categories: how to conserve energy / what are wasteful ways of using energy / 'and also...' section.]* What do you think about possible ways of saving energy? *[Facilitators offer a few suggestions based on the information received during their briefing, researcher color-codes and branches their answers out of the word ENERGY.]* What do you think about wasting energy? Do you know how that happens? *[Facilitators offer a few suggestions, similar to the above].* Now we have a small mind map that is both pictures and words, showing the different solution possibilities for conserving energy. Does anybody have any questions? You can ask them later and your group leaders *[facilitators]* will answer them.

Please begin to brainstorm on the topic that is given to you by your group leader. [Four environmental topics will be covered, one per group. Topics will deal with Environmental Dangers, Recycling & Waste Reduction, Water / Energy / Natural Resources, and Plants & Animals].

[Facilitators will begin to guide their groups with questions, recording feedback on foam boards.]

Thank you for all your ideas, our time for the activity is up. Why don't you take a short break now, while I set up the next activity, which will be playing games! Remember what color group you are in.

[Recess.]

C. Playing Selected Games [Duration: 30 minutes]

Materials: Four existing environmental games, one per group.

Now let's play games! Please find your color groups from before. My assistants will help you with the game rules. You might not finish the game, but that's ok. Just play your game and if you have any comments during the time you are playing, please share them – don't hide or restrain any emotions. Each of the groups will be playing a different game, but please focus on the one you are playing with your group, because even though the games are different, one is not better or more fun than the other. So please enjoy yourselves! Pay attention to the things you like about your game. Also please remember the things you don't like. Do you have any questions before we start?

[Games are played.]

Once again our time is up. If you didn't finish the game it's not a problem. The purpose was not to win or beat your classmates at the game, but to see what you liked or didn't like about the game you were playing. Now you will brainstorm about the games you played, just like you did before when you made mind maps.

D. Game Feedback & Brainstorming [Duration: 20 minutes]

Materials: Guiding questions / topics, brainstorming materials, including foam boards, non-toxic color markers and color pens, notepads, large sheets of paper.

Please stay in your groups and with your group leader. *[Facilitators take their group to the brainstorming area of the class – if there is such a place. Otherwise, the groups stay put.]* By using mind maps, I would like you to talk about what was good about the game you just played and what was bad about it. What would you change? What did you learn? What would you like to learn more about? What did you think about the colors of your game? And what are your thoughts about the characters or pictures? You don't have to remember all the questions I am asking you now, because your group leaders will ask you the same questions when you begin brainstorming. Your honest opinions are very important to me, because the more information and feedback you offer now, the better the game that I design will be. Please begin making your mind maps!

[Facilitators will begin to guide their groups with questions, recording feedback on foam boards.]

That's all for today. You have been a wonderful class and your ideas and reactions have been absolutely great and very useful to me. Thank you so much for all your help. I will now take all the information you have given me and use it to make a new game for you to play when I come back to see you next time. I hope you have enjoyed yourself today and learned something new about the environment too. See you next time.

Research Investigator

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Supervisor

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PROTOCOL: PART 2

Planet Play: Designing a game for children to promote environmental awareness.

Hello again! Last time I was here with my assistants, you played games and brainstormed ideas in small groups. Your ideas from the brainstorming sessions and your reactions to the games that you played have helped me very much and brought me here again with another game for you. This time, just like last time, you will play a game in small groups; my assistants will help you and answer your questions if you don't understand something. After you finish playing, we will all get together in one big circle and you will have a chance to share your thoughts and opinions about the new game.

Phase 2:

A. Game Prototype Testing [Duration: 30 minutes]

Materials: Four variations of environmental game prototype designed by researcher, one per group.

Lets begin playing our games. My assistants will help you with the game rules. Just play your game and if you have any comments during the time you are playing, please share them. Each of the groups will be playing a different game, but please focus on the one you are playing with your group, because even though the games are different, one is not better or more fun than the other. Please pay attention to the things you like about your game. Also please remember the things you don't like. For example – do you like the characters and pictures? The colors? The language used? Please enjoy yourselves! Do you have any questions before we start?

[Games are played.]

B. Game Prototype Feedback [Duration: 30 minutes]

Once again our time is up. If you didn't finish the game it is not a problem. The purpose was not to be the winner by beating your classmates, but to see what you liked or didn't like about the game you were playing. Now you will brainstorm about the games you played, just like last time when I was here. Does anybody need a reminder of what brainstorming is?

[Because the second phase of testing/data collection can happen up to eight weeks apart from the first session, students might need a reminder about graphic organizers, brainstorming and giving feedback in the form of associative thinking. If any students need a reminder about how a brainstorming session is run, then the following will be said:]

I will demonstrate what a brainstorming session is like with my assistants. *[Facilitators leave their groups and join researcher in demonstration.]* Ok, _____, _____, _____, and _____ *[names of facilitators]*, lets brainstorm together on the topic of energy and how we could conserve and save it in the most efficient ways. I will make a mind map based on your answers! *[Using foam board and color markers, researcher writes and circles the word SUN in the center of the board.]* What do you guys think about possible ways of saving energy? *[Facilitators offer a few suggestions based on the information received during their briefing, researcher color-codes and branches their answers out of the word SUN.]* Now we have a small mind map that is both pictures and words, showing the different solution possibilities for conserving energy. Does anybody have any questions? You can ask them later, your group leaders *[facilitators]* will answer them.

By using mind maps, I would like you to talk about what was good about the game you just played and what was bad about it. What would you change? What did you learn? What would you like to learn about more? Did you like the colors of your game? Did you like the characters or pictures? You don't have to remember all the questions I am asking you now, because your group leaders will ask

you the same questions when you begin brainstorming. Your honest opinions are very important to me, because the more information and feedback you offer now, the better the game that I design will be. Please begin making your mind maps!

[Facilitators will begin to guide their groups with questions, recording feedback on foam boards.]

[If all students remember how a brainstorming session is run, then the following will be said:]

If you have any questions, you can always ask them later, your group leaders [facilitators] will answer them. By using mind maps, I would like you to talk about what was good about the game you just played and what was bad about it. What would you change? What did you learn? What would you like to learn about more? Did you like the colors of your game? Did you like the characters or pictures? You don't have to remember all the questions I am asking you now, because your group leaders will ask you the same questions when you begin brainstorming. Your honest opinions are very important to me, because the more information and feedback you offer now, the better the game that I design will be. Please begin making your mind maps! If you have any suggestions of how to improve the game and would like to draw them, please use the materials in front of you.

[Facilitators will begin to guide their groups with questions, recording feedback on foam boards. After 15 minutes of questions/answer feedback, students will either choose to continue contributing feedback until the end of the session, or can use the prototype making materials to express their suggestions physically.]

That's all for today. You have been a wonderful class and your ideas have helped me greatly. The games you played today were actually designed with input and help from you! Your thoughts and opinions last time made these games possible. Thank you so much for all your help. I will now take all the information you have given me today – your opinions about the games you played today – and use this information to make one final game, that combines all the things you like about the games you played today and excludes all the things you didn't enjoy. I hope you had fun today and learned something new about the environment too. Thank you!

[Researcher will answer any further questions if they arise. In the case of child participants displaying interest in the games they played, the researcher will bring them back and leave them with the class upon completion of her thesis research.]

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QUESTIONS for QUESTION CARDS

Planet Play: Designing a game for children to promote environmental awareness.

Topic: General Knowledge

1. When is Earth Day?
2. What are some eco-friendly things you or your parents use?
3. What is a landfill?
4. Where do garbage collectors take your garbage?
5. What do you think the word *environment* means?
6. What are some natural resources?
7. Why should you not flush garbage down the toilet?
8. Where does plastic go when you throw it out?
9. Why does it take a long time for a soda can to decompose?
10. What different kinds of waste/grabage can you name?

Topic: Concerns

1. Why do animals become extinct?
2. What are greenhouse gases?
3. How is pollution created?
4. What causes global warming?
5. Why does some waste take longer to decompose than other waste?

Topic: Prevention

1. What is recycling?
2. Who can help to save the environment?
3. What does it mean to *conserve* and how can you do it?
4. Why is it necessary/good for the environment to have lots of forests?
5. Why should you turn water or lights off when you are not using them?

Topic: Water / Energy / Natural Resources

1. Where does paper come from?
2. Are paper and trees made from the same material?
3. What is more harmful for the environment - taking the bus with others or driving in your own car, and why?
4. What are fossil fuels?
5. Is it better for the environment when you walk somewhere or ride your bicycle, and why?

Topic: Plants and Animals

1. What does it mean when an animal is endangered?
2. What happens if an animal becomes extinct?
3. Why can't all animals live together in the same temperature and the same climate?
4. What is a food chain?
5. Why is it dangerous to cut down forests?

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QUESTIONS for BRAINSTORMING SESSION [Phase 1B]

Planet Play: Designing a game for children to promote environmental awareness.

Topic: Environmental Concerns

1. What is a landfill?
2. How can waste from landfills be harmful to the nearby soil and water if the landfill is not lined correctly and there is a leak?
3. What is pollution and where does it come from?
4. Why do you think pollution produced by cars is dangerous for the environment?
5. Why does our planet need the ozone layer?
6. What is global warming and how can it affect you and your family?

Topic: Recycling and Waste Reduction

1. Why is recycling things good for our planet?
2. Why is some garbage [like plastic] more harmful to our planet than other garbage [like an orange peel]?
3. Why does different waste take different amounts of time to decompose?
4. Why doesn't plastic decompose and rot the same way as an orange peel when you throw it out?
5. Why do you think a soda can or a plastic bottle take longer to decompose than an orange peel?
6. What are some eco-friendly things that you know?

Topic: Water / Energy / Natural Resources

1. What are some fossil fuels that you can name?
2. How are fossil fuels formed and do you think it is that a fast process?
3. Can you name some ways you use energy [like electricity] everyday?
4. When a cow burps or garbage in a landfill decomposes that produces methane gas. Do you think that is really true?
5. What kind of effect do methane gas and other pollution have on our planet?
6. What different sources of energy do you know?
7. What is the name of a black substance that we burn for fuel? [Both coal and oil are correct.]
8. How do you think we can use water from the oceans or the wind or the sun to generate energy for our daily lives?
9. What are some natural resources of energy that we can use instead of fossil fuels?
10. What are some possible ways to travel from your home to the school?

QUESTIONS for BRAINSTORMING SESSION [Phase 1B]

Planet Play: Designing a game for children to promote environmental aw

Topic: Plants and Animals

1. What does it mean when an animal is endangered?
2. What happens to the food chain if one kind of animal becomes extinct?
3. Why can all animals not live [together] in the same habitat?
4. Why is it dangerous for animals when their habitat's temperature changes?
5. If the food/plant an animal eats stops growing because climate has changed, what happens to the animal?
6. Why is it necessary/good for the environment to have lots of forests?

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QUESTIONS for GAMES FEEDBACK [Phase 1D]

Planet Play: Designing a game for children to promote environmental awareness.

1. What were some things you enjoyed the most about the game?
2. Did you feel like you wanted to be more involved and have more turns/take more action during the course of the game?
3. Do you like to play games and if yes, which ones?
4. What kind of things/information did you learn from the game?
5. Which parts and topics of the game would you like to learn more about?
6. What do you think about the colors of the game?
7. What do you think about the characters and pictures of the game?
8. What do you think about the name of the game?
9. How would you suggest the game could be more dynamic and exciting?
10. Were the rules of this gamelike any other games you have played?
11. Did this game seem similar to any other games you know? If yes, which game[s]?
12. Did you think the length of the game was enough for you to fully enjoy it, or would you rather prefer the game to be longer or shorter?
13. Would this game be more enjoyable if you could make your own character and choose your own appearance?
14. What did you think about your character [name, appearance, personality]?
15. Do you have any suggestions for changing anything about the game you just played?
16. Do you have any more ideas, comments, or suggestions?
17. Would you play this game in your free time? [Or again?]

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QUESTIONS for GAMES FEEDBACK [Phase 2B]

Planet Play: Designing a game for children to promote environmental awareness.

1. What were some things you enjoyed the most about the game?
2. Did you feel like you wanted to be more involved and have more turns/take more action during the course of the game?
3. Do you like to play games and if yes, which ones?
4. What kind of things/information did you learn from the game?
5. Which parts and topics of the game would you like to learn more about?
6. What do you think about the colors of the game?
7. What do you think about the characters and pictures of the game?
8. What do you think about the name of the game?
9. How would you suggest the game could be more dynamic and exciting?
10. Were the rules of this gamelike any other games you have played?
11. Did this game seem similar to any other games you know? If yes, which game[s]?
12. Did you think the length of the game was enough for you to fully enjoy it, or would you rather prefer the game to be longer or shorter?
13. Would this game be more enjoyable if you could make your own character and choose your own appearance?
14. Would you prefer your character to be a human, an animal or an object?
15. Do you have any suggestions for changing anything about the game you just played?
16. Do you have any more ideas, comments, or suggestions?
17. Would you play this game in your free time? [Or again?]

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VISUAL ANALYSIS

GAME IMAGES

TABLETOP

Earthopoly

Bioviva

Eco Fluxx

Eco Squad

Catan Scenarios: Oil Expansion

Dirty Water

Eco Planet

R-eco

20 Questions: Nature & Science

Terra

DIGITAL

Sky Taxi 2: Storm

Plan It Green

Eco Match

Word Power: The Green Revolution

[National Geo] Eco Rescue: Rivers

Eco Ego

Tweety's Ocean Cleaning

Landfill Bill

[Greenpeace] Eco Quest

BBC Climate Challenge

PHYSICAL*

1926 Park Adventurers

Identifying Trees

MATRIX DIAGRAMS

Research Question

Data collection and data analysis process

Stage 1

Stage 2

Stage 3

Workshop 1

Workshop 2

**because physical games did not come in a representable format [only instructions available], images will not be included, aside from only two out of ten games.*

Tabletop / EARTHOPOLY



Tabletop / BIOVIVA



Tabletop / ECO FLUXX



Tabletop / ECO SQUAD



Tabletop / CATAN SCENARIOS



Tabletop / DIRTY WATER



Tabletop / ECO PLANET



Tabletop / 20 QUESTIONS



Tabletop / R-ECO



Tabletop / TERRA



Digita / SKY TAXI



Digital / PLAN IT GREEN



Digital / ECO MATCH



Digital / WORD POWER: THE GREEN REVOLUTION



Digital / NATIONAL GEOGRAPHIC, ECO RESCUE: RIVERS



Digital / ECO EGO



Digital / TWEETY'S OCEAN CLEANING



Digital / LANDFILL BILL



Digital / GREENPEACE ECO QUEST



Digital / BBC CLIMATE CHALLENGE



Physical / 1926 PARK ADVENTURERS



Physical / IDENTIFYING TREES

			
ASH	BEECH	HOLLY	SYCAMORE
			
OAK	SILVER BIRCH	HAWTHORN	HORSE CHESTNUT
			
ELM	LIME	ROWAN	ALDER

Designing an educational game for children

ANALYSIS /
DISCUSSION

REFINED
PROTOTYPE

WORKSHOP

PROTOTYPE

WORKSHOP

RESEARCH
QUESTION

Designing an educational
game for children to promote
environmental awareness

VISUAL
ANALYSIS



to promote environmental awareness.

2

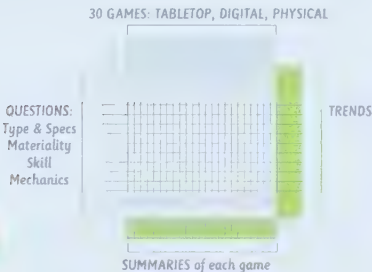


Research Question & Process

How to design an educational game for children

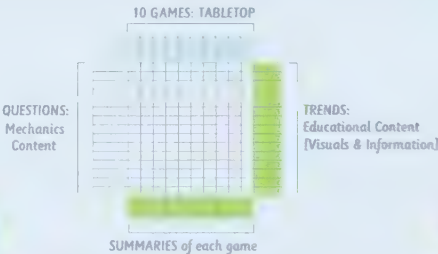
Stage 1 of the Visual Analysis, Matrix Diagram 1
Sketch of the matrix created to determine the basic anatomy and mechanics of 30 environmental games.

Main steps of Stage 1:
Based on the literature, questions are created and applied to 30 games.
Answers are used to determine similarities and differences between games.
Recurrent answers combine into trends, games are summarized.



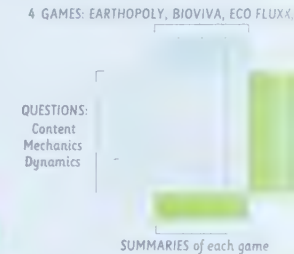
Stage 2 of the Visual Analysis, Matrix Diagram 2
Sketch of the matrix created to determine the type and level of educational content within 10 tabletop games.

Main steps of Stage 2:
Based on stage 1, questions are created and applied to 10 games.
Answers are used to establish the type and level of educational content.
Recurrent answers combine into trends and each game is summarized.



Stage 3 of the Visual Analysis, Matrix Diagram 3
Sketch of the matrix created to determine the design of the content and mechanics within 4 tabletop games.

Main steps of Stage 3:
Based on stage 2, questions are created and applied to 4 games.
Answers are used to establish the design of the content and mechanics.
Recurrent answers combine into trends and each game is summarized.



en to promote environmental awareness?

Diagram 3
ine the design of
top games.

plied to 4 games.
e content and mechanics.
ach game is summarized.

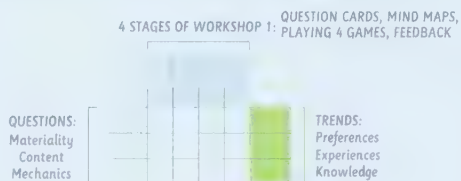
K, ECO SQUAD

Workshop 1 Analysis, Matrix Diagrams 4 & 5

Sketch of the matrix diagram[s] created to determine the experiences, knowledge, and preferences from workshop 1.

Main steps of Stage 4:

Based on stage 3 and workshop 1, the 4 stages of workshop 1 are examined. Answers are used to establish the trends of child participants' experiences, knowledge and preferences regarding environmental games and issues. Trends are combined into a prototype of a board game [Planet Play].



TRENDS:
Design Anatomy
[Visual & Structural]

Workshop 2 Analysis, Matrix Diagram 6

Sketch of the matrix diagram created to determine the experiences, knowledge, and preferences from workshop 2.

Main steps of Stage 5:

Based on stages 1-4, the game prototype and workshop 2 are analyzed. Answers are used to establish the trends of child participants' experiences and preferences regarding the Planet Play prototype. Trends are applied towards refining the Planet Play prototype.



Workshop 1
Question Cards
Mind Maps,
Playing Earthopoly, Bioviva, Eco Fluxx, Eco Squad,
Feedback

Main steps of Workshop 1:

Question Cards were administered for interviews
Mind Maps were created with & by participants
4 games were played for 30 minutes
Feedback was collected about 4 games



Planet Play
[prototype]

Workshop 2
Playing Planet Play
Feedback

Main steps of Workshop 2:

Planet Play was played for 30 minutes
Feedback was collected about Planet Play



Planet Play
[refined prototype]

STAGE 1 | MATRIX 1: VISUAL ANALYSIS OF 30 ENVIRONMENTAL GAMES

BASIC ANATOMY AND MECHANICS IN 30 GAMES

MATERIALITY & TECHNICAL SPECIFICATIONS

TABLETOP

DIGITAL

PHYSICAL

Payment Necessity
Y / N / NA

Payment Frequency
ONCE / NA

Marketed / Described as Educational?
Y / N

Date Of Creation
< 60s / 70s / 80s / 90s / 00s / 10 > / NA

GAME BITS & COMPONENTS

Physical Dimensions
SCREEN / TABLE / ROOM

Number Of Players
SINGLE / MULTI / CO-OP

Time Necessary To Complete
MINUTES / NA

Avatar Or Self Representation
A / SR / EITHER BOTH (E-B)

Target Audience?
CHILD / ADULT / MIX

Pre-defined Levels / Scenarios?
Y / N

Speed and Pace
FAST / SLOW / NA

CORE DYNAMIC

Progression Of Play
TURN BASED / REAL TIME

Goal +
Victory Conditions

GAME NAME

FARTHOPLY

BLOWIA

ECO FLUX

ECO SQUAD

CATAN SCENARIOS: OIL EXPANSION

DIRTY WATER

ECO PLANET

R-ECO

20 QUESTIONS: NATURE & SCIENCE

TERFA

SKY TALK 2: STORM

PLANT GREEN

ECO PLANET

TABLETOP

DIGITAL

PHYSICAL

1

2

3

4

5

11

12

13

14

15

21

22

23

24

25

At most carbon credits
Banrupt other players
Last player to stay in the game

Visual multiple choice
Questions regarding the advance
Collect most eco points and
semble them into a sun
Fastest player to earn points

Follow hanging instructions
Meet the guide card requirements
Last player to stay in the game

Use eco cards to get your value
Use eco cards to get your value
12 ex strong
Finish game with most green cards

Advancing
Balance between
Reserve points
As 5 damaged trees are removed

Save the planet
Use eco cards to get your value
Avoid interfering the game with others
At barriers are involved in all these

Improve the ship, making it eco
Balance between upgrading to green
Techniques and saving money

Transfer the resources to the other
Trees represent environmental status
Puzzle tiles are placed in all these

Use eco cards to get your value
Purchase equipment for your business
Become a successful green energy

Save species and the environment
Affiliates on all levels are seen

Close up the business location where
waste is produced
Avoid interfering the game with others
At barriers are involved in all these

Close up the business location where
waste is produced
Avoid interfering the game with others
At barriers are involved in all these

Close up the business location where
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Close up the business location where
waste is produced
Avoid interfering the game with others
At barriers are involved in all these

[illegible]

FLORA: 30%
FAUNA: 30%
NATURAL RESOURCES: 20%
THREATS / DANGERS: 50%
PRESERVATION TECHNIQUES: 60%
ALL PRESENT EQUALLY: 20%

NUMBER OF PLAYERS
Minimum 2, Maximum 10, Average 6

MONEY or POINTS as REWARD?
50 / 50 distribution.

AVATAR or SELF REPRESENTATION?
Self Representation in all 10 games

WORLD: Balance between real, imaginary, and abstract

TIME PERIOD: 50% Abstract, 40% current, 10% historical

MODERATELY OCCURRING DYNAMIC:
trivia [Q-A] dynamic

LUCK OR STRATEGY?
Balance of both

All games are fairly different and have very few similarities regarding their materiality

Card games have similarities to other card games

Board games have very few similarities (aside from all having boards, but they are unique)

MOST UNIQUE.
No games have similar rules to those of Eco Squad or Biovia.

Only one other game has rules similar to Eco Fluxx, Earthopoly, R-Eco.

LEAST UNIQUE
Catan Scenarios, Dirty Water, and 20 Questions share most rule similarities with other games

STAGE 3, MATRIX 3: VISUAL ANALYSIS OF 4 TABLETOP GAMES		DESIGN OF CONTENT AND MECHANICS IN 4 GAMES	
MATERIALITY		CONTENT	What are the dominant colors in the game? Primary / Primary & Secondary / 1 & 2 / 3
			Is the game made out of environmentally friendly materials? YES / NO
			Are the characters human / animal / object? HUMAN / ANIMAL / ABSTRACT
			What style are the images in the game? ILLUSTRATION / PHOTOGRAPHY
			What is the complexity of the images in the game? ABSTRACT & SIMPLE / REALISTICALLY ILLUSTRATED
MECHANICS			Does the game allow for / include players drawing / writing? YES / NO
			Does the game depend on environmental trivia? YES / NO
			Does the environmental trivia seem complex [for the player]? YES / NO
			Is the trivia more educational or more entertaining? EDUCATIONAL / ENTERTAINING
			Is the trivia distracting from the game? YES / NO
			Does the game contain useful environmental trivia? YES / SOME / NONE
			Is the trivia diverse, including flora, fauna, natural resources? YES / NO
			Is the game world concrete and real or imaginary? CONCRETE & REAL / IMAGINARY & ABSTRACT
			Are the rules complex upon initial exposure? YES / NO
			Are the rules complex upon detailed exposure? YES / NO
			Does the game seem like it would entertain / engage? YES / NO
			What is the speed / pace of the game? FAST [less trivia] / SLOW [more trivia]
			Do players progress one at a time or together? ONE AT A TIME / TOGETHER
			Is the concept of money present in the game? YES / NO
			Can the game be potentially completed / won? YES / NO

	GAME NAME			
	EARTHOPOLY	BIOVIVA	ECO FLUXX	ECO SQUAD
game? 3 / Multi	MULTI [PHOTO]	1 & 2 & 3	1 & 2 & 3	MULTI [PHOTO]
ndly material?	YES	YES	YES	YES
bstract?	ABSTRACT	ABSTRACT	ABSTRACT	ABSTRACT
ame? MIX	MIX	ILLUSTRATION	ILLUSTRATION	MIX
the game? STRATED / MIX	MIX [PHOTO] REAL / [ILL] A & S	ILLUSTRATION REALISTICALLY ILLUSTRATED	ILLUSTRATION REALISTICALLY ILLUSTRATED	MIX [PHOTO] REAL / [ILL] A & S
ting on the components?	NO	NO	NO	YES
a for mechanics?	NO	YES	NO	YES
ge group it is intended)?	NO	NO	NO	NO
tertaining? G	ENTERTAINING	EDUCATIONAL	ENTERTAINING	EDUCATIONAL
oo long)?	NO	NO	NO	NO
suggestions?	SOME	YES	NONE	YES
ces, dangers, and solutions?	NO	YES	NO	YES
ary and abstract? STRACT	IMAGINARY & ABSTRACT	CONCRETE & REAL	IMAGINARY & ABSTRACT	CONCRETE & REAL
mination?	NO	NO	NO	NO
mination?	YES [with exceptions]	NO	YES	NO
age the player[s)?	YES	YES	YES	NO
ame? ivia]	FAST	SLOW	FAST	SLOW
together?	ONE AT A TIME	TOGETHER	ONE AT A TIME	ONE AT A TIME
e game?	YES	NO	NO	NO
within 30 minutes?	NO	NO	YES	YES

All four games made out of environmentally friendly materials [recycled fiber or paper]

No characters or avatars in any of the four games: players represent themselves.

Eco Squad was the most educational, Eco Fluxx was the most entertaining

Bioviva had the most realistic portrayal of Earth

Eco Fluxx the most abstract portrayal of Earth.

Rules to Earthopoly identical to Monopoly.

Bioviva similar to Trivia Pursuit

Eco Fluxx is like R-Eco or Uno

Eco Squad has similarities to 20 Questions or study flash cards.

No presence of money in Bioviva, Eco Fluxx, Eco Squad

Earthopoly dynamic based on buying, trading, and mortgaging

money, buy / sell trade natural resources and some flora carbon credits instead of hotels real life / contemporary themes race to the end / collecting / dynamic characters are absent [play as self] world is imaginary strategy / luck dynamic looks like Location and Eco Planet rules like Dirty Water and Terra plays like Dirty Water and Terra most familiar and known mechanics

no money, only points great balance of enviro / content eco points for correct answers real life / contemporary themes trivia / question / answer dynamic characters are absent [play as self] world is real / concrete contemporary themes and questions strategy / luck dynamic looks like Terra rules like Terra, 20 Q, Eco Planet plays like Terra, Dirty Water most diverse trivia out of all games with layers of connecting content

no money, no points mainly fauna, some flora matching & race to the end dynamic strategy / luck dynamic real life / contemporary themes collection / survival / strategy characters are absent [play as self] world is absent / abstract looks like Eco Squad, R-Eco rules like R-Eco plays like R-Eco, Earthopoly least trivia out of all games

no money, no points, only goal cards preservation & threats / dangers cause / effect / race to the end dynamic collection / strategy / dynamic real life / contemporary themes characters are absent [play as self] world is localized & real looks like Eco Fluxx, R-Eco rules like 20 Questions plays like R-Eco, 20 Questions open ended questions and challenges most content out of all games simplest rules out of all games

COLLECT MOST CARBON CREDITS
BANKRUPT OTHER PLAYERS

LAST PLAYER TO STAY IN THE GAME

ANSWER MULTIPLE CHOICE
QUESTIONS CORRECTLY TO ADVANCE
COLLECT MOST ECO POINTS AND
ASSEMBLE THEM INTO A SUN

FIRST TO COLLECT MOST ECO POINTS

FOLLOW CHANGING INSTRUCTIONS
MEET THE GOAL CARD REQUIREMENTS

LAST PLAYER TO STAY IN THE GAME

USE ECO CARDS TO GET GOAL CARDS
COLLECT MOST GOAL CARDS OUT OF
12 EXISTING

FINISH GAME WITH MOST GOAL CARDS

STAGE 4, MATRIX 4: ANALYSIS OF WORKSHOP 1 [QUESTION CARDS, MIND MAPS]

PARTICIPANTS' EXPERIENCES, PREFERENCES, SUGGESTIONS

CONTENT & MATERIALITY

Did participants enjoy the variety of colors used in the question cards / mind maps?
YES / NO + COMMENT

Did participants express a preference for any particular color used in the question cards / mind maps?
YES / NO + COMMENT

Did participants enjoy the four symbols used in the question cards / mind maps?
YES / NO + COMMENT

Did participants express a preference for any of the four symbols used in the question cards / mind maps?
YES / NO + COMMENT

How did participants react to the complexity of the content used in the question cards / mind maps?
COMMENT

Were participants more / less knowledgeable about any particular part of the content in either the question cards or the mind maps?
MORE / LESS + COMMENT

Did participants express a preference for an aspect of the content in either the question cards or the mind maps?
YES / NO + COMMENT

Did the questions used for the question cards / mind maps engage the participants and seem enjoyable?
YES / NO + COMMENT

Did participants enjoy writing or illustrating their answers on the question cards / mind maps?
YES / NO + COMMENT

Did participants create imaginary characters or words on any of the question cards / mind maps?
YES / NO + COMMENT

WORKSHOP 1

QUESTION CARDS & MIND MAPS

YES. Question Cards: Excitement about the bright colors. Mind Maps: Branches and symbols were commented on.

NO. Question Cards & Mind Maps: Not a preference for a color, but a recognition of some colors [red, blue].

YES. Question Cards & Mind Maps: Symbols were popular with participants and could be used for Planet Play.

YES. Question Cards & Mind Maps: Especially recycling and threats & dangers.

The responses of participants to question cards and mind maps were varied.

[Some of the terms and content were unknown to participants, especially 'fossil fuels' and 'global warming'].

LESS. Question Cards & Mind Maps: Energy sources [fossil fuels] were not familiar to participants.

YES. Question Cards & Mind Maps: Participants wished to see more trivia about animals, minerals, and environmental threats and dangers.

YES. Question Cards & Mind Maps: Participants were most engaged with information that was familiar to them.

YES. Question Cards & Mind Maps: Drawing on the testing materials was preferred by participants the most out of all the other activities that took place in the workshop.

YES. Question Cards & Mind Maps: Participants created imagery, some of which was unrelated to the questions of the question cards and mind maps.

STAGE 4, MATRIX 5: ANALYSIS OF WORKSHOP 1 [4 TABLETOP GAMES, FEEDBACK]

PARTICIPANTS' EXPERIENCES, PREFERENCES, SUGGESTIONS

		WORKSHOP	
		EARTHOPOLY	
MATERIALITY	Did participants enjoy the colors in the game? YES / NO		YES
	Did participants suggest the colors to be the same / brighter / duller? SAME / BRIGHTER / DULLER		SAME
	Did participants react positively to the materiality of the game? YES / NO		YES
	Did participants enjoy the characters of the game? YES / NO		YES
	Did participants suggest changes for the characters? YES / NO		YES
	Did participants enjoy the images used in the game? YES / NO		YES
	Did participants suggest changes for the images used in the game? YES / NO		NO
	Did participants express interest in drawing / writing on the components of the game? YES / NO		YES
	If yes, what did participants prefer to draw / write on the components? YES / NO		ANIMALS & MINERALS
CONTENT	What words were used to summarize the game? YES / NO		TERRIFIC / AWESOME / OUTSTANDING
	Did participants find the trivia of the game too complex? YES / NO		NO
	Were there indications that the trivia was memorable to participants? YES / NO		NO
	Was the trivia [structure / amount] distracting participants from the game? YES / NO		NO
	Did participants enjoy a specific type of the trivia [flora, fauna, dangers, and solutions]? YES / NO		NO
	Which type of trivia did the participant enjoy the most? FLORA / FAUNA / DANGERS / SOLUTIONS		NO A
	Did participants like the game world / visual theme / story? YES / NO		YES
	Did participants have suggestions to improve the game world? YES / NO		YES
MECHANICS	Were the rules complex for participants to follow? YES / NO		NO
	Did the game engage the participants and seem enjoyable? YES / NO		YES
	Did participants find the pace of the game slow / appropriate / too fast? SLOW / APPROPRIATE / TOO FAST		APPROPRIATE
	Did participants enjoy progressing one at a time or together? ONE AT A TIME / TOGETHER		ONE AT A TIME
	Did participants enjoy the presence of money, if it was applicable to their game? YES / NO		YES
	Was the game completed / won within the 30 minute workshop? YES / NO		NO
	Did participants express desire to be more involved / take more action? YES / NO		YES
	Did playing with partners make participants like the game more or less? MORE / LESS		LESS
	Did participants express desire to play the game in their free time? YES / NO		YES

BIOVIVA	ECO FLUXX	ECO SQUAD	
YES	YES	50 / 50	_____
SAME	SAME	BRIGHTER	_____
YES	YES	YES	_____
YES	YES	YES	_____
YES	YES	YES	CREATE OWN
YES	YES	50 / 50	MORE ANIMALS & BRIGHTER COLORS
NO	NO	YES	MORE ANIMALS
YES	YES	YES	_____
ANIMALS & POWERS	THEMSELVES	ANIMALS & THEMSELVES	_____
CHALLENGING / BORING / AMAZING / AWESOME	BEAUTIFUL / ACTIVE / FUN	TERRIFIC / AWESOME / FUN	_____
50 / 50	NO	NO	SOME WORDS / TERMS
YES	NO	YES	POST-GAME COMMENTS
YES	NO	NO	SPEED of GAME, SOME WORDS and TERMS
YES	YES	YES	_____
FAUNA	DANGERS	SOLUTIONS	_____
YES	YES	YES	_____
YES	YES	YES	ADD MONEY, ANIMALS, MINERALS, DANGERS
NO	YES	NO	_____
YES	YES	YES	_____
SLOW	APPROPRIATE	APPROPRIATE	WAITING for OTHER PLAYERS to ANSWER
ONE AT A TIME	ONE AT A TIME	ONE AT A TIME	_____
N / A	N / A	N / A	_____
YES	YES	YES	_____
YES	YES	YES	MAINLY DUE to the SHORT DURATION
LESS	N / A	N / A	_____
YES	YES	YES	_____

To create Planet Play, the following is necessary to consider:

Changing the content of question cards [adjusting complexity, simplifying certain themes and terms];

Keeping the color and form of the symbol for each of the five themes the same [capitalizing on the popularity of the graphic elements];

Isolating the most preferred features of the four games:

Earthopoly's game board structure,

Bioviva's trivia cards,

Eco Squad's environmental symbols

Bioviva's trivia

Eco Fluxx's threats and dangers

Eco Squad's problem / solution approach

Earthopoly's roll-and-move dynamic

Bioviva's reward format

Eco Fluxx's survival dynamic

Eco Squad's open-ended dynamic

Focusing on themes, materiality, dynamics, content from the four games, specifically:

Animals

Concerns and Dangers

Own characters

Environmental symbols

Questions with entertaining and memorable facts

Simple rules

Faster pace

STAGE 5, MATRIX 6: ANALYSIS OF WORKSHOP 2 [PLANET PLAY PROTOTYPE, FEEDBACK]

PARTICIPANTS' EXPERIENCES, PREFERENCES, SUGGESTIONS

MECHANICS

CONTENT

MATERIALITY

Did participants enjoy the colors in Planet Play? YES / NO + COMMENT	50 / 50	PLA
Did participants suggest the colors to be the same / brighter / duller? SAME / BRIGHTER / DULLER + COMMENT		BRIG
Did participants react positively to the materiality of Planet Play? YES / NO + COMMENT		YES
Did participants make suggestions for the game components? YES / NO + COMMENT		SOM
Did participants enjoy making their own characters? YES / NO + COMMENT		YES
Did participants suggest changes for the characters? YES / NO + COMMENT		SOM
Did participants enjoy the images used in Planet Play? YES / NO + COMMENT		YES
Did participants suggest changes for the images used in Planet Play? YES / NO + COMMENT		NO
What words were used to summarize Planet Play? COMMENT		FUN
Did participants find the trivia of the game too complex? YES / NO + COMMENT		NO
Were there indications that the trivia was memorable to participants? YES / NO + COMMENT		YES
Was the trivia [structure / amount] distracting participants from the game? YES / NO + COMMENT		SOM orde
Did participants enjoy a specific type of the trivia [flora, fauna, dangers, and solutions]? YES / NO + COMMENT		YES
Which type of trivia did participant enjoy the most? FLORA / FAUNA / DANGERS / SOLUTIONS + COMMENT		FLO
Did participants like the Planet Play world / visual theme / story? YES / NO + COMMENT		NO
Did participants have suggestions to improve the Planet Play world? YES / NO + COMMENT		NO
Were the rules of Planet Play complex for participants to follow? YES / NO + COMMENT		NO
Did Planet Play engage the participants and seem enjoyable? YES / NO + COMMENT		YES
Did participants find the pace of Planet Play slow / appropriate / too fast? SLOW / APPROPRIATE / TOO FAST + COMMENT		SL O sh
Did participants enjoy the presence of Eco Efforts? YES / NO + COMMENT		YES
Did the participants suggest changes for Eco Efforts? YES / NO + COMMENT		NO
Did Planet Play remind participants of any games they have played before? YES / NO + COMMENT		YES play
Did participants express desire to be more involved / take more action? YES / NO + COMMENT		YES inv
Did playing with partners make participants like the game more or less? MORE / LESS + COMMENT		NO
Did participants express desire to play Planet Play in their free time? YES / NO + COMMENT		YES

SHOP 2

PLAY & FEEDBACK [EXPERIENCES, PREFERENCES, SUGGESTIONS]

expressed a generally positive reaction to the game components. Made suggestions about dullness.

R. There was a desire for brighter and sharper colors.

Participants especially loved the dice and the skull and bones and threats and dangers symbols of the question cards.

Increase the size of the game board or decrease the size of the character passports; more bright colors.

Participants enjoyed both drawing and naming their characters and wished to dedicate more time to that activity.

More colors [markers] for creating the characters; more time for creating the characters.

Consistent with the previous workshop, the environmental symbols used in Planet Play were much enjoyed by the groups.

TOO SHORT. These descriptors were given to Planet Play mainly because there was not enough time to play it fully.

Participants mentioned and discussed fun facts derived from the game's questions after the workshop was over.

The trivia itself was not too complex, however the questions should be either re-worded or read twice / repeated in order to emphasize the main points.

Questions were not commented on by participants, however flora / fauna trivia was memorable and discussed.

FAUNA, DANGERS. Participants expressed the most enthusiasm towards animals and plants.

COMMENTS / NEUTRAL. Participants did not express any like or dislike regarding the theme of the game.

Conceptually] / Materiality could be changed – larger board.

Participants became engaged in the game and began enjoying it 2/3rds of the way in, close to the end.

Due to the large numbers of players in each group, the game pace was slow. Decreasing the number of players would increase the speed / pace of the game play.

Never perceived them as / compared them to [play] money all the time.

Participants were continuously comparing Planet Play to Earthopoly, however mainly because they wished to be Earthopoly instead [due to the presence of play money].

Only because the pace of the game was slowed down by the large numbers of players, participants wished to be more engaged and have their turn faster and more frequently.

COMMENTS / NEUTRAL. Participants did not express any like or dislike regarding playing the game with partners.

Changes to be made to Planet Play as suggested by the participants and observations:

Increase the size of the game board [outer cells] to fit character passports.

Slightly decrease character passport cards [big enough to draw on, small enough to fit on the game board].

Keep the layout of the six symbols and the game board the same.

Print everything in brighter and more saturated colors [on lighter colored or thinner card stock].

Re-design the ecos to look less like money [maybe large and round, resembling the game board].

Adjust the rules of the game to:

specify a number of players [minimum 2, maximum 6];

before starting game, always shuffle all the card decks well;

instruct players to begin the game with a set amount of ecos;

require question card readers to read the card twice and / or re-read the italicized words;

require players who are losing ecos [negative deeds] to take ecos from the player to their left

QUESTION CARD TRANSCRIPTIONS

QUESTION CARDS:

General Knowledge

1. When is Earth Day?

*1. I don't know. Oh! I know sorry. April 27th. *Picture of a large question mark.*

2. What are some eco-friendly things you or your parents use?

*1. Recycle paper, walking to the store, recycle bottle, riding train, using a bike, picking up garbage, composting, throwing garbage properly. *Picture of trashcan and what looks like compost with worms.*

*2. I bring bags because I want to be the environment [I bring my own bags because I want to help the environment]. *Picture of a building titled 'market' and 'superstore' and a girl walking inside it with a bag.*

3. What is a landfill?

Both have pictures of landfills and garbage.

*1. *Picture of a mass, can be understood as a landfill.*

*2. *Picture of various types of garbage, including banana peels.*

4. Where do garbage collectors take your garbage?

Both have pictures of landfills and garbage trucks on top of them.

*1. Landfill. *Picture of a landfill and two garbage trucks on each side of it.*

*2. They can take it to landfills. *Picture of a landfill and a garbage truck on top of it.*

5. What do you think the word environment means?

*1. It means that caring for the world. *Picture of the world [planet / globe].*

*2. Trees, wheat, rivers. *Picture of trees, one with a happy face and arms; picture of what looks like river and wheat.*

6. What are some natural resources that you know?

*1. The trees are giving off air for us to breathe. *Picture of trees.*

*2. *Picture of the recycling symbol.*

7. Why should you not flush garbage down the toilet?

1. If you flush stuff down the toilet it goes down ocean sewer then the will go down the toilet go down and it then it will [hard to decipher the flow of words, no hierarchy. Most likely – “The waste will end up in the ocean then back in your toilet”].

*2. *Picture of a green toilet.*

8. Where does plastic go when you throw it out?

*1. It goes to recycle. *Picture of the recycling symbol.*

*2. *Picture of a forest [labeled 'forest'] with trees and animals inside it, all living on top of plastic garbage.*

9. Why does it take a long time for a soda can to decompose?

*1. Because it is a metal. Because it's non-biodegradable. *Picture of a juice box with a straw, labeled 'soda'.*

2. Because timing. Because it is not a dichotic thing. [It takes longer because it is not biodegradable.]

10. What different kinds of waste/garbage can you name?

1. Food, bike, wrappers.

*2. Banana peels, old pop cans, milk containers. *Picture of a milk container, a banana peel and a soda can.*

Total: 19 answers

Pictures & Text: 16

Picture only: 5 [Q3x(2) <definition of landfill>, Q5 <what are natural resources>, Q7 <flush garbage down toilet>,

Q8 <disposing of plastic>]

Text only: 3 [Q7 <flush garbage down toilet>, Q9 <soda can decomposition time>, Q10 <different types of waste>]

Dangers & Concerns

1. Why do animals become extinct?

All three have pictures of animals [becoming extinct].

*1. *Picture of four-legged animal and trees in blue, next to yellow tree and people/animals covered in fur. [Could be interpreted as cold and hot temperatures contrasting].*

*2. Not right temperature. *Picture of a sweating dinosaur with a box of tissues, under blazing sun.*

*3. Because it living life and mostly all of them animals do that. [Complicated logic, could possibly be interpreted as either natural progress of life / death.] *Picture of animal saying "Bye mom" and either exploding or bleeding. [This card and the background is the same as the fossil fuels card, where there can almost be seen a progression between an animal becoming extinct and forming into fossil fuels.]*

2. What are greenhouse gases?

1. Greenhouse gases are from animals like a cow when it burps. [connection to other question card & my intro speech]

*2. I don't know. *Picture of a question mark.*

3. How is pollution created?

*1. Humans, factories. *Picture of factory and exhaust coming from chimney. Picture of water with dead fish and waste and a man on the pier.*

*2. *Picture of planes, dynamite, two people.*

3. The pollution come from bus, car.

4. What causes global warming?

*1. *Picture of a car.*

- *2. Car accident. 1 box with the word 'recycling' inside it and a cross next to it} – not recycling? Picture of two cars.
- 3. By throwing wrong things. [By disposing of non-biodegradable waste, connection to my intro speech]
- 5. Why does some waste take longer to decompose than other waste?
 - 1. Because some people put bottles to tray [trash?] and decompos. [Because garbage is not sorted properly]
 - *2. Picture of tree with white on it [Oxygen? Snow?], grass, blue cloud.

Total: 13 answers

Pictures & Text: 9

Picture only: 4 [Q1 <animals becoming extinct>, Q3 <how is pollution created>, Q4 <causes of global warming>, Q5 < waste decomposition time >]

Text only: 4 [Q2 <greenhouse gases>, Q3 <pollution>, Q4 <global warming>, Q5 <waste decomposition time>]

Recycling & Waste Management

1. What is recycling?

All three have pictures of recycling containers.

- *1. Give banana peels to a worm bin. Make compost. Picture of a person standing over a container with a banana peel and a worm next to the container.
- *2. Recycling is like putting usable things that can be fixed in the recycle bin and it can get fixed up again. Picture of a box with the word 'recycle' written on it.
- *3. Can is. Picture of what could be understood as a recycling container with a non-organic object inside.

2. Who can help to save the environment?

- *1. Trees. Picture of a tree.
- *2. Picture of a vehicle with exhaust around it.

3. What does it mean to conserve and how can you do it?

- *1. To not use something again and again to save the environment! Picture of the recycling symbol on a box and three big hearts.
- *2. Do not step on the plants. Picture of twigs and flowers.
- 3. So you don't have to pay lots.

4. Why is it necessary/good for the environment to have lots of forests?

- 1. Give us oxygen, wood paper. We can build houses.
- *2. It gives lots of air. Picture of a forest with clouds over it and grass under it.

5. Why should you turn water or lights off when you are not using them?

- *1. Because [if] you doesn't use it [Because you are not using it]. Picture of a classroom [two desks, two chairs] and a bright light over them.
- *2. The water is going to be wasted. Picture of a large pool of water.

Total: 12 answers

Pictures & Text: 10

Picture only: 1 [Q2 <who can save the environment>]

Text only: 2 [Q3 <how to conserve> and Q4 <importance of forests for environment>]

Water Energy Natural Resources

1. Where does paper come from?

Both have pictures of trees.

- *1. Paper comes from trees. Picture of a tree.
- *2. Picture of a tree.

2. Are paper and trees made from the same material?

All three have pictures of trees and paper / notebook. Picture of a trees, a happy face and notebook . paper.

- *1. Trees are not made of paper, but paper is made of trees.
- *2. Because trees are made of wood and paper is made of trees, only it goes to a machine. Picture of two trees with a notebook . paper between them.
- *3. Paper and trees are made from the same material. Picture of a tree and paper . notebook.

3. What is more harmful for the environment - taking the bus with others or driving in your own car? Why?

- *1. Bus is badet [worse]. Picture of a bus.
- 2. I think that taking the bus is more harmful because it uses more gas than a car and gas can cause pollution in the air that we breathe.
- 3. I think it's more harmful to ride in your own car.

4. What are fossil fuels?

- *1. Cars [c]use fuels. [Cause or use?]. Picture of a car and exhaust clouds.
- *2. Picture of animal buried under ground and under grass.

5. Is it better for the environment when you walk somewhere or ride your bicycle? Why?

Both have pictures of girl on grass and on a road. Probably personification , identification with subject matter.

*1. It is better to walk, than ride a bike. *Picture of a girl on a road.*

*2. Walk. *Picture of a girl on grass and next to a road.*

Total: 12 answers

Pictures & Text: 10

Picture only: 2 [Q1 <fossil fuels>, Q1 <origin of paper>]

Text only: 2 [Q3 <bus or car>]

Plants & Animals

1. What does it mean when an animal is endangered?

All three have pictures

*1. *Picture of people in what looks like a tank, and an animal on the ground with blood coming out of its head.*

*2. There are a lot of animals. Then there is only one left. *Picture of a group of animals – creatures and an arrow leading from it pointing to one single creature – animal, clearly showing progression.*

*3. It means that it is in trouble. *Picture of thumbs up and thumbs down, thumbs down is circled*

2. What happens if an animal becomes extinct?

Both have pictures of animals

*1. It decomposes. *Picture of an animal [turtle?] on the ground.*

*2. The animal died and it never comes back. *Pictures of two sad looking animals, most likely a cat and definitely a bunny, with the labels 'dead' and 'bunny'.*

3. Why can't all animals live together in the same temperature and the same climate?

*1. Because some of the animals live in colder weather and some live in warmer weather. *Picture of an animal's head saying "cold"*

*2. Because some animal[s] have fur and some of them doesn't [don't]. If an animal went to a desert with fur, they will get hot. *Picture of two animals against mountains, one with snow [the animal says "cold"] and one without snow [the animal says "hot"]. Both animals are unhappy*

*3. Because some animals, like polar bears, can't stay in hot temperature. Flowers cannot stay in cold temperature

4. What is a food chain?

*1. Worms, bird, cat. *Picture [diagram!] of a food chain with labels: worms, then bird, then cat.*

*2. Save the environment. *Picture of a tree, sun and cloud*

5. Why is it dangerous to cut down forests?

All three have pictures of trees – plants

*1. Because it might fall down on you or it might ruin[ed] the environment sometimes. *Picture of a tree falling onto a laughing – yelling person*

*2. *Picture of a crying bunny and a wilting – dead flower.*

*3. You won't be able to breathe. *Picture of a person with horns [indicating evil?] and a tree stump.*

Total: 13 answers

Pictures & Text: 12

Picture only: 2 [Q5 <danger of cutting down forests>, Q1 <endangered animals>]

Text only: 1 [Q3 <animals and climate>]

MIND MAP PHOTOGRAPHS





PLANET PLAY QUESTIONS



Reduce, recycle, reuse =
all the same.

Yes, that's true.
*No way!

Recycling is part of the waste disposal
hierarchy – first try to Reduce, then try to
Reuse, and only finally Recycle.



There are actual islands and
mountains made out of trash.

*Yes, that's true.
No way!

The highest point in Hamilton County,
Ohio (near Cincinnati) is Mount
Rumpke. It is actually a mountain of
trash at the Rumpke sanitary landfill
towering 1045 ft. above sea level.



The oceans are melting slowly, it
will not be a huge difference to
our planet.

Yes, that's true.
*No way!

The oceans cover almost three quarters of
the earth. If all the ice in glaciers & ice
sheets melt, the sea level would rise by
about 80 meters, about the height of a 26
story building.



Every ton of paper that is recycled
saves 17 trees.

*Yes, that's true.
No way!

Try to imagine all your paper and all
paper-based packaging as a tree every time.



It takes more energy to recycle
aluminum cans than to make new
ones.

Yes, that's true.
*No way!

90% less energy goes into recycling
aluminum cans than it does into making
new ones!



All materials take a different
amount of time to decompose.

*Yes, that's true.
No way!

It takes plastics 500 years, aluminum cans
take 500 years. Organic materials like
cotton, rags, and paper take 6 months to
biodegrade.



50 million homes can be heated for
20 years with the amount of paper
and wood that is thrown out every
year.

*Yes, that's true.v
No way!

Unfortunately, that is true. If we recycle and
reuse wood and paper instead of throwing
it away, we would be saving thousands of
trees and wasting a lot less energy for
keeping our homes and water warm.



All modes of fuel-operated
transportation are equally bad
for the environment.

Yes, that's true.
*No way!

It is all about how many people can fit
into a vehicle. One bus carries as many
people as 40 cars!



About a million pounds of trash is
dumped into the ocean every year.

Yes, that's true.
*No way!

Actually it's not million, it's billion! 14
billion pounds of trash is dumped into
the ocean every year.



About 50% of all our garbage is
recyclable.

Yes, that's true.
*No way!

It's more! 84 percent of all household
waste can be recycled. Each person
throws away approximately 4 pounds of
garbage per day. This adds up to almost
a ton of trash per person, per year.



Recycling things can create extra
energy to power other things that
work with electricity.

*Yes, that's true.
No way!


1 recycled tin can would save enough
energy to power a television for 3 hours.
1 recycled glass bottle would save
enough energy to power a computer for
25 minutes. 1 recycled plastic bottle
would save enough energy to power a
60-watt light bulb for 3 hours.



We eat all the food that we buy.
Or at least we should.

Yes, that's true.
*No way!


In developed countries, 30% of the food
purchased is thrown away each year.
That amount could feed 2 billion people
for a whole year.



Every piece of plastic ever made still exists today.

*Yes, that's true.
No way!


Plastic degrades for hundreds and sometimes thousands of years, and since it was invented in the 20th century, it hasn't even had 100 years to decompose.



Products should be minimally packaged to avoid waste.

*Yes, that's true.
No way!


About one-third of an average dump is made up of packaging material! Out of every \$10 spent buying things, \$1 (10%) goes for packaging that is thrown away. Packaging represents about 65% of household trash.



50 million homes can be heated for 20 years with the amount of paper and wood that is thrown out every year.

*Yes, that's true.v
No way!


Unfortunately, that is true. If we recycle and reuse wood and paper instead of throwing it away, we would be saving thousands of trees and wasting a lot less energy for keeping our homes and water warm.



Saying no to soaking in a bath, but taking a shower instead can save 100 liters [26 gallons] of water.

*Yes, that's true.
No way!


100 liters [26 gallons] is how much water a person uses over 3 weeks in many parts of Africa. So choosing to take a quick shower and not a bath is environmentally responsible behavior.



Always rinse your plates off before putting them into the dishwasher.

Yes, that's true.
*No way!


Do not rinse the dishes, scrape the food off, then put them into the dishwasher = save 15 gallons of water.



In one week we go through 10 billion plastic bags worldwide.

*Yes, that's true.
No way!


Too much shopping, too much packaging, too much plastic EVERYWHERE. Every day, every week, every month, etc. Our life is becoming consumed with plastic.



A third of the water that is used in our homes is wasted by being flushed down the toilet.

*Yes, that's true.
No way!


Yes, almost 13.2 liters [3.5 gallons] of water is wasted down the toilet with each flush. This can be prevented by installing low-flow toilet tanks or even by placing a brick into the toilet tank!



Recycling things can create extra energy to power other things that work with electricity.

*Yes, that's true.
No way!


1 recycled tin can would save enough energy to power a television for 3 hours.
1 recycled glass bottle would save enough energy to power a computer for 25 minutes.
1 recycled plastic bottle would save enough energy to power a 60-watt light bulb for 3 hours.



Grocery and other coupons are harmless. Just small pieces of paper that give you better deals!

Yes, that's true.
*No way!


1.135 million trees are killed each month to make paper grocery coupons. That's the size of two Central Parks in New York!



Supermarkets and their use of packaging and bags is one of the worst things about shopping in big chain stores.

*Yes, that's true.
No way!


If you had a 15-year-old tree and made it into paper grocery bags, you'd get about 700 of them. A busy supermarket could use all of them in under an hour! This means in one year, one supermarket can go through over 6 million paper bags!



A 100-watt light bulb can shine for 2 hours by using the energy saved from recycling only 1 glass bottle.

Yes, that's true.
*No way!


If you recycle 1 glass bottle, the energy saved from that can run a 100-watt light bulb for 4 hours. So, if you recycle 2 glass bottles, that would save enough energy to run our light bulb for 8 hours!



About 50% of all our garbage is recyclable.

Yes, that's true.
*No way!


It's more! 84 percent of all household waste can be recycled. Each person throws away approximately 4 pounds of garbage per day. This adds up to almost a ton of trash per person, per year.



Is it true that by combining a boat and a house you can get a 'houseboat'? And live on the water in a floating house?

*Yes, it's true.
No way!


Yes, houseboats are a popular way to live if you are living in an area of the world that is by the water. Houseboats have kitchens, bathrooms and bedrooms, just like a normal home would.



Can installing solar panels on the roof of a house be a way to heat up your home and the water used for washing and bathing?

*Yes, it can.
No way!


Yes, solar panels use the sun's energy to generate electricity and are a way of creating renewable energy. They produce energy from the sun's light.



All fertilizer is toxic and full of chemicals. To be effective, fertilizer cannot be organic.

Yes, that's true.
*No way!


Fertilizer can be organic and free of chemicals! And you can make it yourself, by composting vegetable waste and using the compost as fertilizer.



If you want the lights in your home to be nice and bright, you shouldn't use energy saving light bulbs, because they don't produce enough light.

Yes, that's true.
*No way!


Energy efficient bulbs use 75% less energy than regular light bulbs, but the amount and brightness of light they give out is exactly the same as regular light bulbs!



The icebergs in Antarctica are made from rain and snow that came down around 250,000 years ago and then froze.

*Yes, that's true.
No way!


It takes hundreds of thousands of years for rain and snow that fall from the sky to form into icebergs. So you can say that it was rain and snow that sunk the Titanic in 1912!



If you walked down a flight of stairs from highest point on Earth to the deepest point on Earth, you would take 26,400 steps.

*Yes, that's true.
No way!


Mount Everest is the highest location on Earth; it goes all the way up to 8,849 meters [29,000 feet]. And the Mariana Trench is the deepest place on Earth, going down to 10,971 meters [36,000 feet]!



50 million homes can be heated for 20 years with the amount of paper and wood that is thrown out every year.

*Yes, that's true.
No way!


Unfortunately, that is true. If we recycle and reuse wood and paper instead of throwing it away, we would be saving thousands of trees and wasting a lot less energy for keeping our homes and water warm.



A third of the water that is used in our homes is wasted by being flushed down the toilet.

*Yes, that's true.
No way!


Yes, almost 13.2 liters [3.5 gallons] of water is wasted down the toilet with each flush. This can be prevented by installing low-flow toilet tanks or even by placing a brick into the toilet tank!



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Saying no to soaking in a bath, but taking a shower instead can save 100 liters [26 gallons] of water.

*Yes, that's true.
No way!


100 liters [26 gallons] is how much water a person uses over 3 weeks in many parts of Africa. So choosing to take a quick shower and not a bath is environmentally responsible behavior.



The deepest lake in the world is approximately 2 thousand steps deep, which is equal to the height of the CN Tower.

Yes, that's true.
*No way!

Lake Baikal in Siberia is 1620 meters [5300 feet] deep. The CN Tower is 553 meters [1,815.4 feet] tall. The lake is as deep as approximately 3 CN Towers stacked on top of each other!



Trees feed on oxygen. They take it in, convert it into carbon dioxide and give it back into the atmosphere.

Yes, that's true.
*No way!

It is the opposite, actually. In one year, a full-grown tree can convert almost 20 kg [44 pounds] of carbon dioxide into clean oxygen. That's a small library of clean air!

When you chop onions and cry, it is because you can feel that the onion is sad and dying.

Yes, that's true.

*No way!

Actually, the onion begins a gas attack on you! It releases a gas that irritates your eyes and your eyes produce tears to wash away the gas.

Some flowers are carnivores [they eat meat]!

*Yes, that's true.

No way!

They don't eat steak, but some plants take their nutrients from eating various small insects and spiders! For example, the Venus Flytrap – when an insect touches the hairs of a Venus Fly Trap, this triggers the plant to close, trapping its victim before killing and dissolving it in acid.

All plants and animals have been discovered.

Yes, that's true.

*No way!

There exist approximately 10 million species of life on Earth and biologists expect to still discover up to 5 million marine plants and animals! Now is the time to maybe become a scientist...

Squirrels are environmentally unfriendly, dangerous animals.

Yes, that's true.

*No way!

The opposite. Squirrels actually save our environment and plant millions of trees! They bury their nuts, but forget where and those are the happy accidents that create new trees.

Some animals can act as a home for other animals [and this is not about kangaroos].

*Yes, that's true.

No way!

This is a classic example of parasite behavior. A whale can support many different types of life that attach to the whale's skin and can live there comfortably! Like in a floating home.

The number of endangered species does not increase [grow / go up].

Yes, that's true.

*No way!

Unfortunately, as of today, there are 11,167 species of plants and animals that are already endangered. This number keeps growing every year.

Animals don't help each other, if they are not from the same family.

Yes, that's true.

*No way!

Animals take care of each other. For example, fish help out other fish by removing parasites and dead skin from their scales. Dogs like to adopt orphaned cats, squirrels, ducks and even tigers! And if chimpanzees and bats have food, they will share it with their group.

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Yes, that's true.

*No way!

Lake Baikal in Siberia is 1620 meters [5300 feet] deep. The CN Tower is 553 meters (1,815.4 feet) tall. The lake is as deep as approximately 3 CN Towers stacked on top of each other!

Some animals have superpowers.

*Yes, that's true.

No way!

Most definitely! For example, butterflies taste with their feet and turtles can breathe through their butts. A rabbit's teeth never stop growing and a giraffe's tongue is so long that it can clean its ears with it!

Coral reefs are living organisms

*Yes, that's true.

No way!

The Great Barrier Reef in Australia is the largest living structure in the world. Imagine an underwater so big, it can be seen from space! Coral reefs are home of many tropical fish, other animals, and corals.

All birds fly.

Yes, that's true.

*No way!

Some birds were made for flying, but some only for running and even swimming! Penguins have flippers to help them swim in the water and catch fish and an ostrich is the fastest running bird in the world, but neither of them can fly.

Honey is the only food that can never go bad.

*Yes, that's true.

No way!

Honey does not rot! Honey that is still in perfectly edible condition was found in ancient Egyptian pyramids, making it thousands of years old.



Hurricane!

There has been a hurricane in your area and your home and garden are very damaged. You must rebuild your own things and help others rebuild theirs.

You lose: 100 Ecos

As well as violent winds and heavy rain, hurricanes can also create tornadoes, high waves and widespread flooding.



Oil Spill!

A tanker carrying oil had an oil spill into the open waters. You donate money to contribute to clean up activities.

You lose: 100 Ecos

According to the National Academy of Sciences, on average there are 27 oil spills every day somewhere in the waters of the world.



Draught!

Because of extremely dry weather, no crops could be planted, so nothing grew. Now your groceries are super expensive, because they must be imported or

You lose: 100 Ecos

Global warming causes extreme weather conditions, such as heat waves and lack of rain, which leads to draughts.



Hail Storm!

A destructive hail storm came down last night and now your car has small dents and scratches that need to be fixed.

You lose: 50 Ecos

Global warming causes extreme weather conditions, such as heavy rain and extremely cold temperatures; the combination of those leads to hail storms.



Earthquake!

There was an earthquake with a magnitude of 5.3! Your bookshelves broke and you need to fix them or get new ones.

You lose: 50 Ecos

Earthquake magnitude is measured along a Richter scale: 1 being the weakest and 10 the strongest. Most of the time, you cannot feel earthquakes when they happen, which is all the time!



Waste Dumped into Ocean!

A family of fish is on the verge of extinction. You donate money to scientific research to help prevent complete extinction of the fish family.

You lose: 100 Ecos

Plastic bags and other plastic garbage thrown into the ocean kill as many as 1,000,000 sea creatures every year!



Pollution Fog!

Too many cars per family and the pollution is unbearable! Now you need to walk around the city wearing a mask.

You lose: 50 Ecos

Too many cars in the city caused by people buying more than one vehicle per family. This creates pollution and generally terrible air conditions.



Forest Fire!

Devastating forest fires came through your neighborhood forests. You donate to help re-plant.

You lose: 100 Ecos

Forest fires are bad enough, but especially worse because they carry very quickly and consume huge areas in one go.



Overgrazing!

Your groceries are much more expensive this year because grazing lands in your area have been over-used and now most things that you at have to be imported from other counties.

You lose: 100 Ecos

Overgrazing not only raises the price of food, but also causes soil erosion, making the pastures unusable for the future.



Flood!

There was a big flood after heavy rainfall, so now you need to deal with fixing what can be fixed and properly disposing of the things that are ruined.

You lose: 70 Ecos

Global warming causes extreme weather conditions, such as heavy rain, which leads to floods.



Heat Wave!

You can't work, can't sleep, can't do anything but sit by the air conditioner! What a waste of time and electricity as well.

You lose: 70 Ecos

Global warming causes extreme weather conditions, such as temperature becoming too hot or too cold very quickly.



Landfill Leak!

One of the landfills in your city began to leak. This toxic leak absorbed into the soil and surrounding water. The entire city feels the damage.

You lose: 100 Ecos

Landfills leak because they are too full. If people recycled as much as possible, there would be less toxic garbage going into landfills.

Turn Up the Heat

You are at home, feeling chilly. So you turn up the heat instead of putting on a sweater and some warm socks.

You lose: 50 Ecos

Want, Buy, Want, Buy

You saw it on TV, now you want it, you can't live without it, and you must have it! So you buy it. And now you want the newest version of it. So you buy that too. See, want, buy, want, buy, buy, buy!

You lose: 150 Ecos

Buy, not Fix.

Something broke and you could get it repaired...but the newer, better version is coming out, so you will just wait to get that instead. That way you'll have the latest, best one!

You lose: 100 Ecos

Dry Clothes in the Drier [clothesline]

Your laundry is done, so now you must dry it. What better faster way to do it than the drier? Use a clothesline next time!

You lose: 70 Ecos

Drink Tap Water

You discover that drinking tap water saves money and saves the environment! You only drink tap water from now on and tell your friends about your discovery.

You win: 100 Ecos

Drink Water, Not Pop

You find out that drinking regular water is much healthier for you than sugary pop! You start to drink tap water instead of pop and tell your friends about your discovery.

You win: 50 Ecos

More Fruit, Less Juice

You hear that eating a real fruit is much healthier for you than drinking fruit juice! You start to carry fruit with you and eat it instead of drinking packaged juices, loaded with unhealthy sugar

You win: 50 Ecos

Buy in Bulk

Turns out that if you buy foods in bulk, you save money and have less to recycle and throw out! You begin buying nuts, grains and cereals in bulk.

You win: 50 Ecos

Adopt Animals

You decided that you are ready to take care of a pet! Instead of buying one from a pet store, you adopt and bring your new friend to his new home

You win: 100 Ecos

Wear Fur

You heard that it is fashionable, hip, and trendy to dress up in beautiful fur. So you bought a coat made out of fox and a hat made from bear.

You lose: 150 Ecos

Use Plastic Shopping Bags

You go shopping and bring back all your new stuff in plastic bags. If you bring reusable bags with you next time, you will not be wasteful and will also buy less!

You lose: 50 Ecos

Use a Reusable Water Bottle

You and your friend are thirsty. You fill up your reusable water bottle from the tap, but your friend doesn't have one and decides to buy a bottle of water. You offer your friend a drink from your reusable bottle instead!

You win: 100 Ecos

Use Reusable Food Containers

You know it is healthier for you to bring your own lunch than to buy something when you are hungry. You carry your food in a reusable food container.

You win: 20 Ecos

Play Music to your plants

You read that plants are sensitive to music! So you start enjoying your music and sharing it with your plant friends.

You win: 20 Ecos

Dress Up When Cold

You are at home, feeling chilly. So you put on a sweater and some warm socks instead of turning up the heat.

You win: 50 Ecos

Recycle Paper

You heard that recycling 1 ton of paper saves about 16 trees! You collect all the used and unwanted paper in your home and take it to the recycling container.

You win: 70 Ecos

Drink Tap Water

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You win: 100 Ecos



Recycle Glass

First, you make the effort to collect all the unwanted glass in your home. Then you recycle it so it can be melted down to make new glass!

You win: 70 Ecos



Trade Old for New

Trading with friends and neighbors just makes sense. Their old things can still be new to you and the things you only use once in a blue moon can be shared and become new to someone else.

You win: 50 Ecos



Collect Rainwater

The weather is rainy, but you have decided to make the most of it. You collect rainwater into a bucket and water all the plants in your house!

You win: 50 Ecos



Recycle Plastic

At home, you collect all the used and unwanted plastic and take it to the recycling container. You want to keep it out of landfills!

You win: 70 Ecos



Use Reusable Food Containers

You know it is healthier for you to bring your own lunch than to buy something when you are hungry. You carry your food in a reusable food container.


You win: 20 Ecos



Recycle Paper

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You win: 70 Ecos



Recycle Aluminum Cans

You heard that recycled aluminum cans are melted down and made into new cans over and over again! You collect all the used and unwanted cans in your home and recycle them.

You win: 70 Ecos



Use a Reusable Water Bottle

You and your friend are thirsty. You fill up your reusable water bottle from the tap, but your friend doesn't have one and decides to buy a bottle of water. You offer your friend a drink from your reusable bottle instead!

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You win: 100 Ecos



Use Less Dish Soap

The dishes need to be washed again, so you decide to use a quarter less dish soap than you usually do. The dishes are just as clean and squeaky!

You win: 50 Ecos



Reduce Detergent Amounts

You wonder if that putting less detergent into your laundry will wash the clothes just as well. And it does, plus you saved a quarter of your detergent!


You win: 50 Ecos



Impulse Shop

Remember that these things are meant to be special, but nothing is special when it happens all the time. Do you really need so much stuff? Again? Want only what you need, but only what you really need.

You lose: 100 Ecos



Use the Oven

To heat up your lunch, you pre-heat the oven and then keep checking on the progress of your food by opening and closing the oven door. Microwaves and toasters eat up a lot less energy than ovens do, so use them next time!


You lose: 50 Ecos



Dry Clothes in the Drier [clothesline]

Your laundry is done, so now you must dry it. What better faster way to do it than the drier? Use a clothesline next time!

You lose: 70 Ecos



Use Regular Light Bulbs

You think that the lights in your home are going to be less bright and pleasant if you start to use Energy-Efficient Light Bulbs [CFLs].

You lose: 70 Ecos



Throw Plastic in the Garbage

You are thirsty, so you buy a bottle of water. After you drink it, you throw the bottle in the garbage instead of recycling it with other plastic.

You lose: 100 Ecos



Leave Water Running

The toothpaste is on your brush, the brush is in your mouth, but the water is still running! If you are not using the water, why keep it on?

You lose: 50 Ecos



Save Water During Showers

Your shampoo smells delicious and the bubbles it makes are great! You know that you can enjoy your shower and still save water by turning it off when you don't need it.

You win: 50 Ecos



Use Plastic Shopping Bags

You go shopping and bring back all your new stuff in plastic bags. If you bring reusable bags with you next time, you will not be wasteful and will also buy less!

You lose: 50 Ecos



Leave Lights On

You go to the kitchen for a snack and leave the lights on in your room. Something you like is playing on TV, so you stay to watch it for a while, but don't return to your room.

You lose: 70 Ecos



Turn Water Off

You brush your teeth at least twice a day, so just imagine how much water you save when you turn it off every time you are brushing? You turn the water off and keep brushing!

You win 50 Ecos



Use Less Dish Soap

The dishes need to be washed again, so you decide to use a quarter less dish soap than you usually do. The dishes are just as clean and squeaky!

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You wonder if that putting less detergent into your laundry will wash the clothes just as well. And it does, plus you saved a quarter of your detergent!

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Ride a Bicycle

You are lucky to have a bike and know how to ride it! You know that you have an eco-friendly and healthy way to get places without waiting for public transit.

You win: 50 Ecos



Dress Up When Cold

You are at home, feeling chilly. So you put on a sweater and some warm socks instead of turning up the heat.

You win: 50 Ecos



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More Fruit, Less Juice

You hear that eating a real fruit is much healthier for you than drinking fruit juice! You start to carry fruit with you and eat it instead of drinking packaged juices, loaded with unhealthy sugar.

You win: 50 Ecos



Turn Off the Lights

You feel hungry, so you go to the kitchen for a snack. You remember to turn the lights off in your room, because you may be gone for a while.

You win: 50 Ecos



Buy in Bulk

Turns out that if you buy foods in bulk, you save money and have less to recycle and throw out! You begin buying nuts, grains and cereals in bulk.

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PLANET PLAY PROTOTYPE & DISPLAY



Exhibition Display







name your "character passport." Your character passport can be anything you want. You may write only your name, or illustrate a full body, face, and clothing of your character as you imagine it, as you want it to be. A human character name should not have more than 2-3 syllables and

your character's card indicates the amount of ecos and what you must collect to win the game. When you win, you must return your character's card to the game.

All players begin at GO. During the game, each time a player reaches and passes GO, they will draw a card from the eco effort stack to add to their character's card.

When a symbol comes up on the dice, move your character passport to the symbol on the Planet Play board.

The questioner picks the top card from the question card stacks category, to the symbol rolled by the player. The questioner reads the question and waits for the player to respond. If the player answers correctly, they are awarded the amount of ecos that the question was worth. If the player answers incorrectly, the questioner reads the correct answer along with the trivia that the player was given. The questioner puts the question card back into its category stack.

After the questioner reads the next player to roll the dice.

When a player rolls the dice lands showing a category symbol, the player moves their character passport to the category symbol on the Planet Play board. The player sitting next to them picks up a question from the corresponding category, reads it out loud to the player, and gives ecos for a correct answer. The first player to reach the amount of ecos and the amount and type of eco efforts indicated on their goal card wins the game.

*The eco effort and passing GO awards the player with an eco effort of their choice. The player's card states the rules of eco effort they want to use. The player then chooses to go through the eco effort stack, drawing all eco effort cards and giving eco effort to the player. The eco effort cards that do not meet the rules requirements are immediately put back into the bottom of the stack. If the eco effort is a negative deed, and this is the only time in the game when the player gets to take a negative deed, it is the only time they can take a negative deed.

**The eco effort of the question card moves forward in the game. The player who is next to the player rolling the dice is the first to pass GO.

***Ecos are kept in stacks of 20, 50, 100 in the middle of the board. Whoever is the questioner for the round, it is their duty to keep the eco effort stacks.



Eco Efforts

If a player rolls an eco effort category question, they move to the eco effort symbol that is nearest to them on the Planet Play board (same action as for all the other symbols). The questioner picks the top card from the eco effort stack and reads it out loud to the player. The player then takes the card from the questioner and keeps it for the duration of the game, adding it to their collection of eco efforts. If the eco effort rewards the player with ecos for an environmentally friendly effort, the questioner distributes the required amount from the collective stacks of ecos. If the eco effort punishes the player for an environmentally unfriendly deed, the player hands over the required amount of ecos from their collection over to the collective stacks of ecos.



Disasters

If a player rolls a disaster category question, they move to the disaster symbol that is nearest to them on the Planet Play board (same action as for all the other symbols). The questioner picks the top card from the disaster stack and reads it out loud to the player. The disaster category always requires the player to hand over the required amount of ecos from their collection over to the collective stacks of ecos.

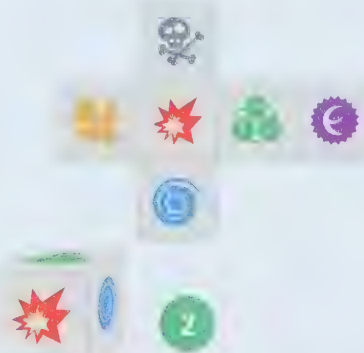
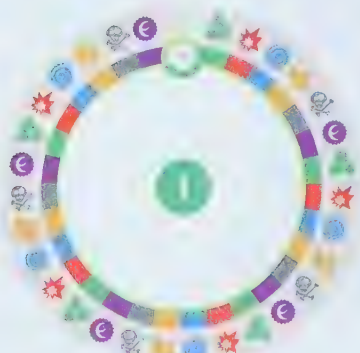
The question cards should always be shuffled very well prior to beginning the game. All card categories' stacks are to be facing with their writing side down and symbol side up.

The question cards should always be arranged according to their category. The question cards should always stay separate from each other (six stacks in total).



Prototype Components*

* NOT TO SCALE



goal
card

650 ecos

3

1

2

Prototype Components*

* NOT TO SCALE



C13488